About Nordic Ecolabelled

Stoves

Version 4.8

Background to ecolabelling
7 January 2026

Nordic Ecolabelling

Content

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Contact information

In 1989, the Nordic Council of Ministers decided to introduce a voluntary official ecolabel, the Nordic Ecolabel. These organisations/companies operate the Nordic ecolabelling system on behalf of their own country's government. For more information, see the websites:

Denmark
Ecolabelling Denmark
www.ecolabel.dk

Finland
Ecolabelling Finland
www.ecolabel.fi

Iceland
Ecolabelling Iceland
www.svanurinn.is

Norway
Miljømerking
www.svanemerket.no

Sweden
Ecolabelling Sweden
www.ecolabel.se

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1 Summary

Nordic Ecolabelled wood-burning stoves, inset fireplaces, pellet stoves and heat-accumulating stoves such as tiled stoves and stove mass heaters (which Nordic Ecolabelling gives the overall designation of "closed fireplaces") are relatively simple combustion systems of approximately 3-15 kW. The primary function of the fireplace is to function as a supplement to the building's primary heating system, but in certain cases it may serve as the building's primary heating system in, for example, low-energy buildings (heat-accumulating stoves and pellet stoves).

Nordic Ecolabelled closed fireplaces are designed for the combustion of solid biofuel such as wood, wood pellets or other biofuels. Combustion of solid biofuel has a climate effect and therefore not climate neutral. The advantage of the combustion of biomass is that it does not add more CO_2 to the climate system, as is the case with fossil fuels. The uptake of CO_2 from biofuels is also much faster than from fossil sources. Biofuel has a relatively short-lived climate impact compared to fossil CO_2, the exposure lasts for several thousand years[1].

The burning of biomass fuels contributes to emissions of, among other things, particles, volatile hydrocarbons (OGC), carbon dioxide (CO), nitrogen oxides (NOx) and Carbon Black on combustion. It is therefore important that increased combustion of biofuel does not increase emissions to the air and derived health effects.

Life cycle analyses show that the largest element of the environmental impact occurs during operation of the fireplace, i.e. as emissions to air.

In this revision it is proposed, first and foremost, to significantly tighten the requirements of emissions to air and efficiency. Emissions have a negative effect on health and the emission volumes vary considerably between the various types of fireplace. The requirements concerning the use of chemicals with hazard classifications in final production are also tightened. A new requirement has been added that Products used for surface paint/-varnish must contain a maximum (VOC 60%). Also, a new use and quality requirements have been added in the form of requirements of pressure testing. In addition, new requirements are proposed concerning the extraction of natural stone primarily used for surfacing and heat accumulation. Finally, the requirement concerning noise for pellet stoves is tightened.

Emission and efficiency data from licence holders shows that it is possible to tighten the Nordic Ecolabel's current requirements of particles, CO, OGC and efficiency. For manually operated fireplaces and insert fireplaces for intermittent use, the Nordic Ecolabel now proposes tighter emission requirements for CO, OGC and particles, compared to DIN+. DIN+ makes further requirements of emissions of NOx, which are not subject to the Nordic Ecolabel requirements. The efficiency requirement is tightened from 75% to 76%. The requirement for emissions of particles is tightened from 3g/kg to 2g/kg during the license period.

[1] http://www.cicero.uio.no/fulltext/index_e.aspx?id=8878

For pellet stoves, the Nordic Ecolabel proposes more stringent requirements of particle emissions and efficiency compared to DIN+ and Der Blaue Engel, while emissions of CO and OGC are at the same requirement level. For heat-accumulating stoves, the requirements of emissions of OGC and efficiency are also tightened.

The revision has investigated the status for new technologies that can improve the closed fireplace's combustion and problems concerning emissions of Black Carbon (BC). Both areas must be studied more closely in the future assessment of the criteria.

Requirements of testing and test methods are updated in relation to current standards.

Requirements of installation and user manuals are updated with for example, requirements for information about the chimney height for each fireplace..

2 Basic facts about the criteria

2.1 Products that can be labelled

The product group includes a number of different product types that all share in common that they are fired with solid biofuel (wood, pellets, briquettes, etc.) and radiate heat in the rooms in which they are located. The fireplace/stove is a closed fireplace, which means that combustion takes place in a closed fire chamber. The criteria include both local heat sources and heat sources that can be used in a heating system. Local closed fireplaces are not usually dimensioned to be able heat the entire building, but act as a complement to the building's primary heating source. The following product types are subject to the criteria document:

- Heat-accumulating fireplaces in which the heat energy is stored in solid material (usually stone), but in certain cases can also be accumulated in water in a tank.
- Manually operated fireplaces for intermittent combustion. Fireplaces that are designed to complement another heat source.
- Automatically-operated fireplaces designed for the combustion of wood pellets (pellet stoves).
- Inset fireplaces for intermittent combustion.
- Sauna stoves

Solar collectors may be included in the heating system. Open fireplaces (fires) and stoves designed for liquid fuel are not covered by the criteria document.

Background to the requirement:
In the criteria version 3 the product group was expanded to "manually fired stoves" for continuous combustion. A stove that can burn around the clock and act as a dominant source of heat in e.g. a low energy house. The term "continuous use" is problematic. The idea behind the requirement was to differentiate stoves/inset fireplaces that are designed to cover a low-energy house primary heat demand (high efficiency and low emissions). This obviously does not mean that there must be fire in the stove all the time. The requirement is in fact aimed more at a particular technology (stoves with two burning chambers), where we see very low emissions and high efficiency. Product type "manually operated stoves/fireplaces for continuous combustion" is removed from the product group criteria version 4.

2.2 Version and validity of the criteria

The criteria for closed fireplaces were approved for the first time on 6 June 2001 with validity until 5 June 2004, version 1.0.

On 15 June 2003, the criteria were expanded with wood-fired sauna stoves and a change to Chapter 7.3.3 Alternative testing methods. The criteria's validity was extended to June 2006, version 1.1.

The criteria were evaluated in autumn 2004 and some changes were added to the criteria document. An adjustment of the documentation requirement for air emissions and the opportunity to use alternative test methods for noise were added to the criteria document, version 1.2.

On 10 May 2005, the criteria were extended to 3 March 2007, version 1.3. On 23 March 2006, the revised criteria version 2.0 were approved, with validity until March 2009. On this revision, the threshold values for emissions were tightened.

On 6 February 2008, the criteria were extended by one year to March 2010.

The criteria were evaluated in autumn 2008. On 3 December 2008, a new measurement method was added with a new threshold value for particle emissions for heat-accumulating fireplaces in K19. The criteria's validity was extended by one year to March 2011, version 2.2.

On 12 October 2010, the revised criteria version 3.0 were approved, with validity until October 2014. In this revision, new materials requirements were added, and the threshold values for emissions and efficiency were tightened.

On 10 October 2012, an exemption was added for hardener of paint/varnish classified with R43 in K3, version 3.1.

The criteria (version 3.1) were evaluated in the spring of 2013 and adopted by NMN in June 2013.

On 11 June 2014, the revised criteria generation 4 were approved, with validity until June 2019. In this revision, new requirement to VOC content in the surface paint were added, and the threshold values for emissions and efficiency were tightened.

On 14 October 2015 adjustments were made in requirement O18 Installation manual and O19 Operating and maintenance instructions regarding informaion on chimney height and the lighting method. On 21 October 2015 requirement O14 Emissions to air were adjusted regarding the values for emissions of particles. The values were adjusted for manually operated stove from 3.0 g/kg to 3 g/kg and from 2.0 g/kg to 2 g/kg in July 2017.On 18 November 2015 it was decided to add an exemption for the use of surface paint in spray cans regaring the VOC content in O6. On 17 November 2014 it was decided to remove requirement R31 Marketing. New version is 4.1.

On the 9 October 2017 Nordic Ecolabelling’s Criteria Group decided to remove O29 Take-back system. This has been done as an editorial change the version has not been changed.

Nordic Ecolabelling's Criteria Group decided on 7 February 2018 to prolong the criteria with 16 months to the 31 October 2020. Version 4.2.

Nordic Ecolabelling decided on 19 December 2018 to prolong the criteria with 20 months to the 30 June 2022. Version 4.3.

Nordic Ecolabelling decided on 26 January 2021 to prolong the criteria with 18 months to the 31 December 2023. Version 4.4.

Nordic Ecolabelling decided on 30 November 2021 to prolong the criteria with 12 months to the 31 December 2024. Version 4.5.

Nordic Ecolabelling decided on 29 November 2022 to prolong the criteria with 12 months to the 31 December 2025. Version 4.6.

Nordic Ecolabelling decided on 21 November 2023 to prolong the criteria with 12 months to the 31 December 2026. Version 4.7.

Nordic Ecolabelling decided on 7 January 2026 to prolong the criteria with 10 months to the 1 October 2027. Version 4.8.

2.3 Justification for Nordic Ecolabelling

Relevant environmental parameters and the potential for improvements in the product's life cycle have been assessed and are described in previous evaluations and revisions. The work has led to the criteria setting requirements in the following areas:

- Emissions to air are limited via threshold values laid down for health- or environmentally-hazardous emissions of carbon monoxide (CO), organic gaseous carbon/volatile hydrocarbons (OGC) and particles.
- The utilisation of the energy content of the biofuel by making requirements of the stove's efficiency.
- Requirement of use of chemicals in production in order to prevent the unnecessary spreading of environmental toxins and to improve the working environment.
- Materials must comply with the relevant requirements in standards.
- Products used for surface coating / varnish must maximum contain (VOC 60%). There are also requirements for metal coatings and PVC-free packaging.
- Emissions to the air are regulated indirectly via the information required in the installation and user manuals for volumes of combustion air, type of smoke flue, recommendation of the chimney height, lighting instructions, etc. The purpose is to ensure optimum combustion that reduces emissions to air and makes efficient use of the wood's energy content.

3 RPS summary

This chapter presents a summary of the RPS analysis prepared in connection with evaluation for this product group. Nordic Ecolabelling uses RPS as a tool to analyse whether environmental problems are relevant (R), whether there is potential for improvement (P), and whether a licence holder has the control measures in place to achieve these environmental improvements. Life cycle analyses (see Chapter 5) show that the largest

element of the environmental impact occurs during operation of the fireplace, i.e. as emissions to air. Requirements of emissions and efficiency are the controlling parameters in the criteria document.

Raw materials extraction and production

These phases of the life cycle are naturally relevant, but not as significant as the operational phase (R).

Life cycle analyses[2,3,4] show that the largest element of the environmental impact occurs during operation of the fireplace, i.e. as emissions.

The Norwegian study has considered "input-output" data where the main components was the production of birchwood (forestry and felling, transport, cutting and transport to the consumer), and the production and operation of wood-burning stoves. The results show that the operational phase represents more than 60% of the environmental impacts. The analyses also show that replacement from old to new stove technology leads to significant improvements (28-80%) for all environmental parameters studied.

The criteria (version 3) make few requirements of production and materials, so that there is potential to develop them and thereby contribute to a reduced environmental impact. The more that the Nordic Ecolabel and the authorities tighten the requirements of the use phase, the more relevant it will be to make requirements of raw materials and production, viewed in an LCA perspective.

It is unclear how much potential there is for substitution of materials and items used in production. With regard to the use of chemicals in final production, there are significant environmental/health benefits from discontinuing the use of VOC products for surface finishing. Experience with the present criteria has also shown that it is possible to substitute CMR-classified chemical products with environmentally-sounder products. (P)

Requirements of the coating of stone/stone production must be investigated more closely in a revision of the criteria. (R) (P) (S)

Operation

Nordic Ecolabelling contributes by setting requirements so that only the best stoves, with low emissions affecting health and the environment, and high efficiency, can be labelled. Emissions to air are measured in optimum laboratory/test conditions. The actual emission picture and the actual efficiency are often lower, due to chimney quality (sealing, draught conditions), the behaviour of the person lighting the fireplace, the wood's quality and moisture content, and whether other materials than wood are used as fuel. The Nordic Ecolabel has no control of these factors. However, we can seek to influence these factors with requirements of good and correct information in installation and operations manuals. (S)

Relevance (R), potential (P) and controllability (S) are good as information in installation and operating manuals, competence of installation technicians, and other information to

[2] Solli, Chr. et al. "Life Cycle Assessment of Wood Based Heating in Norway" Int J Life Cycle Assess (2009) 14:517–528
[3] Cleaner Product Development Based on Life Cycle Assessment: Lithuanian Experience", Jurgis Staniskis, Visvaldas Varzinskas, Institute of Environmental Engineering (APINI), Kaunas University of Technology, 2005
[4] http://www.dovetailinc.org/files/Life%20Cycle%20Impacts%20of%20Heating%20with%20Wood.pdf

customers that affects their behaviour when using the fireplace (lighting-up videos, etc.). The communication of the distributor/installation technician concerning the acquisition of a stove (size of stove (kW), chimney, type of stove) may be of great significance to the customer's decision to buy. In summary, criteria should be developed for additional requirements of manufacturers to increase the competence of installation technicians/distributors, as well as the information they provide to guide the customer to take an environmentally-sound purchase decision.

There are several ways to reduce the actual emissions that occur when the home owner lights the stove. Examples include stoves equipped with automatic control of combustion (automatic control of air intake), electronic control of combustion (lambda probe or equivalent technique), afterburners or other smoke cleaning technique. In future revision of the criteria, the project group should consider the opportunity to set requirements to new technologies without at the same time controlling the technology. (P)

End-of-life

The degree of material recycling for wood-burning stoves and similar fireplaces is already very high today, so that the contribution from Nordic Ecolabelling is very limited. (P)

Less use of materials that are hazardous to health and the environment in the production of the fireplace can naturally contribute to a reduced environmental impact from waste. (R) The same applies to the labelling of materials used for the dismantling and separation of materials. (P)

Summary

RPS is found for the following:

- for requirements of the classification of chemical products and classification of component substances. In addition, also high RPS to exclude or reduce specific problematic substances such as halogenated organic solvents and phthalates;
- to reduce VOC from surfacing finishing and hardening of surface paint;
- to tighten the requirement concerning emissions that are hazardous to health and the environment to the air in the operating phase;
- to make requirements of the fireplace's efficiency in the operational phase;
- for information for the installation, operation and maintenance of the fireplace;
- for information to distributors and installation technicians for competent installation;
- to make requirements of the finishing of stoves with natural stone and stone production.

4 Market description

4.1 The Nordic Market

Combustion of solid biofuel in the form of wood and wood pellets in wood-burning stoves or boilers is an option commonly used to heat homes in the Nordic region. In 2008, the total volume of biofuel to heat buildings in Sweden was equivalent to 11.4 TWh, which constitutes approximately 36% of the total heating requirement.

According to the report from the Swedish Energy Agency entitled ”Småskalig förbränning av fasta biobränslen, 2010” (Small-scale combustion of solid biofuel, 2010) in Sweden there are approximately 1.85 million small-scale combustion facilities, of

which more than 80% are local fireplaces (wood-burning hobs, tiled stoves, open fires, wood-burning stoves and inset fireplaces). These are not used as the primary heating source, but as a heating supplement or for comfort heating (Swedish = trivselvärme). The remaining 20% are boilers for solid biofuel that are used as the primary heating source in buildings.

In its long-term prognosis for types of heating in Sweden, the Swedish Energy Agency assesses that the total consumption of biofuel for heating can be expected to increase by 0.7 TWh during the coming 20-year period[5].

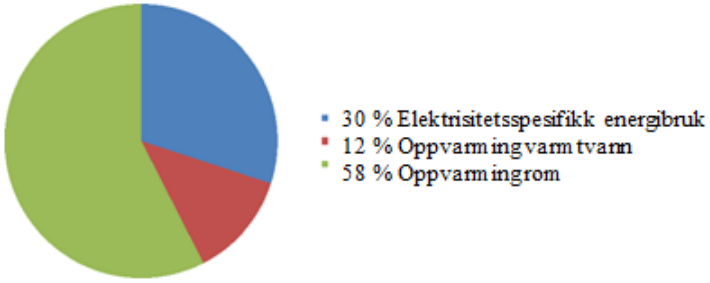
An analysis from the Danish Environmental Protection Agency[6] in Denmark from 2010 assesses the number of wood-burning stoves/inset fireplaces installed in Danish households to be approximately 700,000, the number of wood-fired boilers to be approximately 50,000, and the number of wood-pellet-fired boilers to be approximately 50,000. The number of wood-burning stoves/inset fireplaces has been at the same level for several years. In terms of wood-fired boilers, the development has been to replace old boilers with new boilers, and of these, approximately 80% have accumulator tanks. In the period 2005-2008, the replacement of wood-burning stoves is estimated to have been in the range of 5-8% per annum, equivalent to a level of 25,000-40,000 per annum. The number phased out per year is reported to be approximately equivalent to new registrations, so that the overall stock is more or less constant. There does not seem to be any difference between urban and rural areas, but the rate of replacement seems to be lower in summer cottage areas. Design, fashion and environmental considerations seem to weigh heavily as a force driving replacement in urban areas. There has been most replacement in 2006-2007 compared to 2008, due to the economic crisis, which has naturally also left its mark on this industry.

The total Danish consumption of wood (not including wood pellets) in 2011 totals 23.8 *1015J. This corresponds to a reduction by 5.2% compared to 2009[7]. The total production of wood pellets in 2010 is stated as 1,718,976 tonnes, of which 577,453 tonnes (34%) is used in households[8].

Norway stands out from the rest of Europe with a building stock that is detached to a high degree. 64% of buildings in Norway are homes. 68% of these are detached homes (Norwegian = eneboliger). This entails a high element of individual heating[9].

[5] Small-scale combustion of solid biofuel, Swedish Energy Agency, ER 2010:44.
[6] http://www2.mst.dk/common/Udgivramme/Frame.asp?http://www2.mst.dk/udgiv/publikationer/2010/978-87-92617-85-9/html/kap03.htm$3.3.
[7] http://www.ens.dk/da-DK/Info/TalOgKort/Statistik_og_noegletal/Energistatistik_metoder/Documents/Brændeforbrug%202011.pdf
[8] http://energi7.dk/upload_dir/pics/Det-danske-traepillemarked-2010.pdf
[9] http://www.norskvarme.org/myndigheter/norsk-varme-mener/ Visited 2013-02-22.

Figure 1. Estimated distribution of Norwegian households' energy consumption[10], 2011

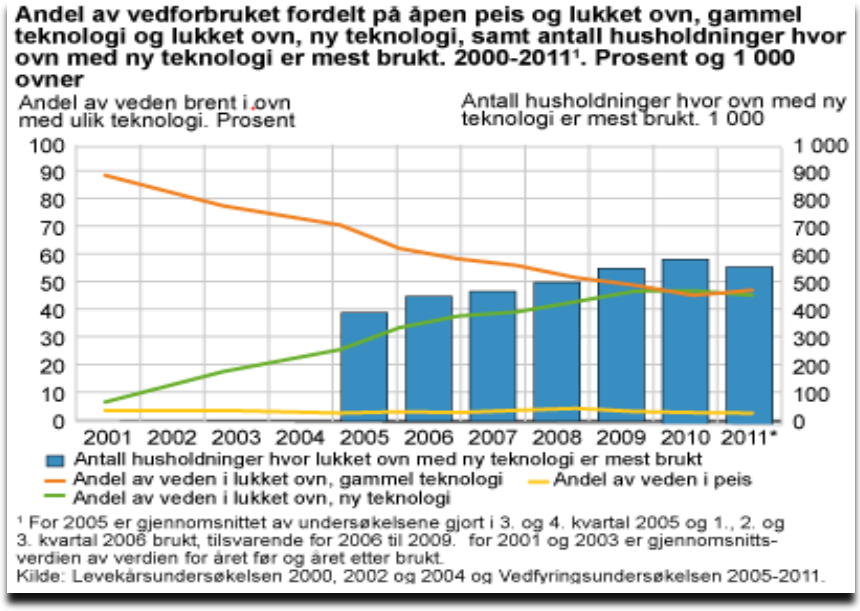


Consumption of biofuel in Norway has increased considerably since 1976. Wood as a ratio of household energy consumption has been rising steadily during the period, but has flattened out since 2005.

This may be due to how heat pumps have replaced some of households' wood consumption[11]. At the same time, the number of new (burning more cleanly and efficient) stoves has increased by 48% from 2005 to 2010. In 2010, almost half of the wood was burned in new stoves [12] (manufactured before1998).

NVE (the Norwegian Water Resources and Energy Directorate) states that Norwegian households use approximately 30 terawatt (TWh) on heating. Of this, 22 TWh is from electricity. Wood burning accounts for 6 TWh. Of 1,280,000 stoves used in Norway (SSB: 2009) a little over 660,000 of them used old technology. These account for 43% of all emissions of suspended particles in Norway.

Figure 2. Statistics from Statistics Norway, SSB,[13] show that an increasing proportion of wood is burned in new and more efficient stoves



New stoves release up to 90% less particles than equivalent old stoves. The total emission of suspended particles can therefore be reduced by 36% by replacing old stoves with new versions. The new stoves also yield 2 TWh extra energy to Norwegian

[10] Energy Consumption in Mainland Norway, Report 9 2011 from NVE (Norwegian Water Resources and Energy Directorate)
[11] Energy Consumption in Mainland Norway, Report 9 2011 from NVE (Norwegian Water Resources and Energy Directorate)
[12] http://www.miljostatus.no/Tema/Luftforurensning/Lokal-luftforurensning/Vedfyring-utslipp/Visited 2013-03-05
[13] http://www.ssb.no/magasinet/miljo/art-2012-06-05-02.html

households. Consumption of wood in Norwegian households and summer cottages in 2009 corresponds to a theoretical energy content of approximately 7.3 TWh. This figure must be corrected for the efficiency of the stove in which the wood is burned, in order to be comparable with electrical heating. In 2009, the energy recovered from wood in households and summer cottages was approximately 3.9 TWh[14].

In Finland, district heating plants account for the largest share of heating of blocks of flats[15]. In newly-built blocks of flats heat pumps, wood or wood-pellet fired boilers are often installed as the central heating source. In houses/bungalows, often a supplementary heat source is installed, such as a wood-burning stove/inset fireplace or heat-accumulating stoves.

In Finland, the total use of wood-based fuel to heat buildings amounts to 16.9 TWh, which is equivalent to approximately 23% of the country's energy consumption in buildings.[16]. In Finland there are also approximately 220,000 oil-fired boilers and 100-200,000 water-based electrical heating systems. These represent potential for conversion to renewable energy sources,[17] such as boilers for solid biofuel.

In conjunction with the revision of the criteria for closed fireplaces, Nordic Ecolabelling Finland has contacted a number of Finnish manufacturers of heat-accumulating stoves to gauge their interest in Nordic Ecolabelling. The feedback from the manufacturers of heat-accumulating stoves included that the followed the CE marking requirements and that in future they required European requirements (ecodesign) rather than a Nordic Ecolabel.

4.2 Development in the market

Interviews with the sector show that the development (sales of stoves) in the Nordic market is negative or, at best, neutral. The development in the European market is improving, which is also reflected in the manufacturers' large export share. Germany, France, the Netherlands, Belgium and the UK are named as the large growth markets. Reasons stated for the declining market in the Nordic region include the economic crisis and resulting lack of new construction, as well as the lapse of economic subsidies to replace old stoves with new versions. The market is subject to strong competition, especially price competition. In recent years, several manufacturers have moved the production of stoves from the Nordic region to especially eastern Europe, from where the products are distributed directly to the customers in order to reduce production costs. In design terms, stoves with a lot of glass are popular, which is a challenge for the stoves' technical characteristics. Glass does not insulate as well as, for example, Skamol or similar insulation material, and this reduces the combustion temperature in the combustion chamber, which in turn gives less clean/efficient combustion.

Modern buildings are better and better insulated and only need a little heating. Most recently, the Building Regulations that entered into force in 2010 (BR10) in Denmark have further reduced the need for a supply of energy, including a supply of energy for heating. Another trend is that buildings are built to be better insulated than before and if this is not taken into account the chimney may not draw properly, resulting in poor

[14] Energy Consumption in Mainland Norway, Report 9 2011 from NVE (Norwegian Water Resources and Energy Directorate)
[15] Helio, Laine 2005. Rakennusten lämmitys. http://ilmasto-opas.fi
[16] Statistics Finland. http://tilastokeskus.fi

combustion. This is supported by a report from the Danish Environmental Protection Agency, which concludes that modern buildings need far smaller wood-burning stoves than those in the market today[18]. According to the Danish Environmental Protection Agency, there are wood-burning stoves in the market today with an output as low as around 3 kW[19]. The same development towards more energy-efficient buildings can be seen in Norway, most recently with the entry into force of Building Regulation Tek 10[20].

The technology development is described in section 7.1.

4.3 Nordic Ecolabelling licences

The table below presents an overview of licences for Nordic Ecolabelled licences in the Nordic market, according to criteria version 3. As the table shows, there are only licences for wood-burning stoves and inset fireplaces. There are 12 manufacturers that have achieved Nordic Ecolabelling of more than 200 models. There has been limited interest in Nordic Ecolabelling of pellet stoves and heat-accumulating stoves.

Table 1. Overview of licences and registration of closed fireplaces, September 2013.

Licence holder	Wood-burning stoves/inset fireplaces	Pellet stoves	Heat-accumulating stoves	Reg. in DK	Reg. in S	Reg. in N	Reg. in Fin
Denmark							
Aduro A/S	x				x	x	x
Morsø Jernstøberi A/S	x				x	x	
Lotus Heating Systems	x				x	x	
Hwam A/S	x				x	x	x
Scan A/S	x				x	x	x
Varde ovne A/S	x				x	x	x
Rais A/S	x				x	x	x
Termatech	x				x	x	x
Sweden							
Nibe AB	x			x		x	x
Keddy AB	x						
Norway							
Jötul AS	x			x	x		x
Dovre A/S	x						

4.4 Official requirements and instruments

4.4.1 The renewable energy directive

The EU's renewable energy directive (2009/28/EC)[21] on the promotion of the use of energy from renewable sources is intended to gradually increase the proportion of renewable energy sources in the EU's total energy consumption to 20% in 2020. The directive is an important element of the European Commission's overall climate and

[18] Environmental project no. 1435, 2012 http://www2.mst.dk/Udgiv/publikationer/2012/07/978-87-92903-34-1.pdf
[19] http://www.mst.dk/Borger/luft/Braendeovne/hvor_stor_skal_ovnen_vaere/ Visited on 13 March 2013
[20] http://www.tu.no/bygg/2012/09/14/moderne-hus-tar-livet-av-vedovnene Visited 5 March 2013
[21] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:DA:PDF

energy package to reduce the EU's greenhouse gas emissions. The directive also helps to improve the EU's supply reliability.

The renewable energy directive includes a distribution between the 27 member states in relation to the overall objective of 20% renewable energy. Denmark and Finland's ratios must be 30% and 38% in 2020, while for Sweden and Norway the ratios must be 49% and 67.5%, respectively (including ratios of renewable energy in the transport sector of 10%). The use of biofuel to heat buildings contributes to fulfilling the objective.

The directive (article 13) states that the member states shall promote conversion technologies that achieve a conversion efficiency of at least 85% for residential and commercial applications.

The member state must also (cf. article 14 of the directive) ensure that certification schemes are available for installers of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems, shallow geothermal systems and heat pumps.

In Sweden, the Swedish Energy Agency, together with the Swedish National Board of Housing, Building and Planning and Swedac (the Swedish Board for Accreditation and Conformity Assessment) has recently reported on its tasks under the renewable energy directive and proposed a system of voluntary certification of installation technicians, with the requirement of accreditation. The proposal entails that the Swedish National Board of Housing, Building and Planning states the requirement specifications via a regulation, and that installation technicians can then achieve certification in accordance with these specifications. The players that draw up certificates must be accredited by Swedac. The proposal was adopted in 2012.[22]

4.4.2 Ecodesign and energy labelling

The work within Energy Related Products[23] is divided into different product categories, called LOTs, in which product studies investigate market data, production data and technical status, and function as a decision-making basis for the European Commission. The decision-making basis must result in environmental requirements (ecodesign regulation and energy labelling regulation) that become mandatory for the product group in the European market.

The work in LOT 15 (Requirement for local space heaters) concerns all local space heating products that primarily function via direct heating and where the energy source is solid fuel (coal, biomass, wood pellets, etc.). The work in LOT 20 concerns the same product group, but in this case the energy source is electricity, gas, liquid fuel, etc. There is thus a certain functional similarity between certain product types in the two ongoing LOT areas, so that the work is run in parallel.

Ecodesign is a good tool to eliminate the poorest closed fireplaces from the market. Energy labelling is a good tool to drive the development towards more energy efficient closed fireplaces.

22
http://omvarldsbevakning.byggtjanst.se/PageFiles/106765/SU1301054%20Certifiering%20av%20v%c3%a4rmeinstallat%c3%b6rer-rev.pdf

23 http://www.eceee.org/Eco_design/products

In July 2013 the European Commission presented a proposal for joint EU requirements for the energy efficiency and emission requirements of products for local space heating[24] (which include wood-burning stoves and open fireplaces). The requirement was voted on on 10 October when the Commission achieved a qualified majority for the requirements of electrical heating products and heating stoves based on liquid or gaseous fossil fuels - but not for requirements of wood-burning stoves, inset fireplaces and open fireplaces, which are now deferred indefinitely.

Energy labelling of products for local space heating was also discussed at the meeting. The energy labelling proposals follow a different set of regulations that are not subject to voting requirements. The Commission succeeded in achieving broad acceptance of the proposals. It will therefore continue with energy labelling, notwithstanding the lacking ecodesign requirements.

The European Commission organized in March 2014 a new working session where participants agreed on a new draft ecodesign requirements for wood stoves, inserts and fireplaces. The new proposal is expected to vote in commission in June/July 2014. Requirements for ecodesign expected to enter into force in 2022. Nordic Ecolabelling is following the development of the EU requirements for wood stoves closely.

Ecodesign requirements

The Commission's proposal of 10 October 2013 for closed fireplaces for solid biofuel was that, as a minimum, these should achieve the seasonal space heating energy efficiency ηs show in table 2 below. The fireplaces must furthermore comply with a number of emission requirements for CO, OGC, NOx and particles, as also shown in the table below.

Table 2. Proposal (rejected) from 10 October 2013 for ecodesign requirements of closed fireplaces for solid biofuel

	Measurement unit	Closed fireplaces	Pellet stoves
Efficiency	%	75	79
Seasonal space heating energy efficiency, ηs	%	?	?
CO	mg/m^3, 13% O_2	1500	250
OGC	mg/m^3, 13% O_2	100	40
Particles	mg/m^3, 13% O_2	40	20
	g/kg, 13% O_2	5 g/kg	
NOx	mg/m^3, 13% O_2	200	200

Energy labelling requirements

Energy labelling of products for local space heating was also discussed at the meeting on 10 October 2013. The energy labelling proposals follow a different set of regulations that are not subject to voting requirements. The Commission succeeded in achieving broad acceptance of the proposals. It will therefore continue with energy labelling, notwithstanding the lacking ecodesign requirements.

Proposals for energy classes from 10 October 2013 for energy labelling of products for local space heaters are presented in the table below. For closed fireplaces (wood-burning

[24] http://www.eceee.org/ecodesign/products/Lot_20_local__room_heating__products

stoves, inset fireplaces) this means that energy classes D – G are excluded from the European market. For pellet stoves this applies to energy classes B-G.

Table 3. Proposal for energy classes from 10 October 2013 for energy labelling of products for local space heating

Energy classes	Seasonal space heating energy efficiency ηs in %
A+++	ηs ≥ 150
A++	125 ≤ ηs < 150
A	98 ≤ ηs < 125
A	90 ≤ ηs < 98
B	82 ≤ ηs < 90
C	75 ≤ ηs < 82
D	36 ≤ ηs < 75
E	34 ≤ ηs < 36
F	30 ≤ ηs < 34
G	ηs < 30

Seasonal space heating energy efficiency is a value that is calculated according to a formula/mathematical model. The basic idea is that seasonal space heating energy efficiency is a more accurate measure for the stove's function since it takes account of the output from the stove in different seasons. The ecodesign and energy labelling regulation's energy efficiency requirements are proposed to be defined as an efficiency of the biomass fuel adjusted by a biomass conversion factor of 1.15 that takes account of renewable characteristics of the biomass fuel. Seasonal space heating efficiency is abbreviated to ηs and pronounced "eta-s". Eta-s is defined as ηs = ηe * conversion factor 1.15. The test basis for energy efficiency is EN13240 for wood-burning stoves and similar, and EN14785 for pellet stoves, respectively. I.e. the same standards as are used by the industry and the Nordic Ecolabel today.

4.4.3 RoHS directive and REACH regulation

RoHS 2 (Restriction on Hazardous Substances)
It is relevant to name the RoHS directive in the criteria for closed fireplaces as this can be relevant for pellet stoves subject to electronic control. In principle, RoHS includes all electrical and electronic equipment. RoHS is intended to protect consumers from hazardous substances. Brominated flame retardants can, for example, cause foetal deformation and cancer.

In addition, the equipment is less environmentally hazardous if it later becomes waste, and it can be easier to recycle the waste.

As from 1 July 2006, new electrical and electronic equipment may not contain the following hazardous substances:

- Lead
- Mercury
- Cadmium
- Hexavalent chromium
- PBB and/or PBDE

Threshold values: The threshold value for the hazardous substances listed is 0.1% by weight in homogeneous material besides cadmium, where the limit is 0.01% by weight in homogeneous material.

The directive is evaluated and revised on a continuous basis in order to adapt the requirements to the scientific and technical development, as well as in cooperation with manufacturers of electrical and electronic products, the material recovery industry, environmental organisations and consumer organisations.

The REACH regulation
The REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) regulation (no. 1907/2006) with reference to the ECHA (European Chemical Agency) candidate list, annex 1 (http://echa.europa.eu/chem_data/candidate_list_en.asp) contains an overview of hazardous substances, cf. the definition: "Substances of Very High Concern (SVHC)". The candidate list is published by ECHA and the substances on the list are subject to the authorities' official requirements when the European Commission has confirmed the substances on the list. Before the substances are confirmed by the Commission, Nordic Ecolabelling pays particular attention to these substances and often makes requirements of them in relevant criteria.

How are REACH and RoHS 2 related to each other?
RoHS and REACH are two different acts with different scope and objectives. RoHS 2 is a sector-specific directive that lays down regulations to limit certain hazardous substances in EE products, while REACH is a general act that regulates the registration, evaluation, authorisation and restriction of chemical substances.

RoHS 2 and REACH apply in parallel. REACH also includes regulations to limit substances in various programmes, but in principle there should not be any overlaps, so that restrictions to the specific use of substances in EE should not be addressed by REACH[25].

4.4.4 CE marking

According to the EU's building regulations directive, a number of products must be CE marked before they may be marketed, sold and used in the EU member states. EN13240 is the basis for the CE marking requirements and thus includes requirements of the CE marking of wood-burning stoves and inset fireplaces.

Table 4. Requirements of the CE marking of stoves subject to EN13240

Test basis	EN13240
Efficiency	≥ 50%
CO	≤ 1.0%

Stoves must carry a CE marking plate that at least carries the following information:

- CE mark
- Nominal output in kW
- The measured CO value
- The measured efficiency

[25] http://ec.europa.eu/environment/waste/rohs_eee/pdf/faq.pdf

- Distance to flammable material

4.4.5 Austrian authorities' requirements (Art. 15A)

Like the Nordic Ecolabelling criteria, the Austrian authorities set requirements of carbon monoxide (CO), volatile hydrocarbons (OGC), particles and efficiency, which is tested under several loads. The environmental requirement includes NOx.

For manually fed fireplaces (wood-burning stoves) the requirement of efficiency and CO is tighter than the Nordic Ecolabel requirements (version 3). For automatically fed fireplaces (pellet stoves) the CO requirement is tighter than the Nordic Ecolabel requirements.

Table 5. Austrian authorities' requirements (Art.15a B-VG)[26] tested in accordance with EN13240 for manually fed fireplaces and EN 14785 for automatically fed fireplaces

	Manually fed fireplaces	Automatically fed fireplaces
Efficiency	≥ 78%	≥ 78%
NOx	≤ 150 mg/MJ (≈225 mg/Nm^3)	≤ 150 mg/MJ (≈225 mg/Nm^3)
CO	≤ 1100 mg/MJ (≈1650 mg/NM^3)	≤ 500 mg/MJ (≈750 mg/Nm^3)
OGC	≤ 80 mg/MJ (≈120 mg/Nm^3)	≤ 40 mg/MJ (≈60 mg/Nm^3)
Particles	≤ 60 mg/MJ (≈90 mg/Nm^3)	≤ 60 mg/MJ (≈90 mg/Nm^3)

4.4.6 German authorities' requirements

In Germany, the authorities set requirements of carbon monoxide (CO), particles and efficiency, which are tested under several loads. The requirement of CO, particles and efficiency lies below the Nordic Ecolabel's equivalent requirement (version 3). Particles are tested in accordance with EN13240. The requirement of the efficiency of pellet stoves is the same as in the Nordic Ecolabel (≥ 85%).

As from 31/12-2014 the requirements of CO and particles are tightened, cf. Stufe 2[27]. For heat-accumulating stoves, the requirement of particles (≤ 40 mg/Nm^3) is tighter than the Nordic Ecolabel requirement (≤ 50 mg/Nm^3). For pellet stoves the requirement of CO (≤ 250 mg/Nm^3) is tighter than the Nordic Ecolabel requirement (≤ 1,200 mg/Nm^3). The requirement of particles (≤ 30 mg/Nm^3) is at the level of the Nordic Ecolabel requirement (≤ 3.5g/kg). For wood-burning stoves the requirement of CO (≤ 1250mg/Nm^3) is tighter than the Nordic Ecolabel requirement (≤ 1,700 mg/Nm^3).

[26] http://www.richtigheizen.at/fileadmin/site/richtigheizen/Emissionsgrenzwerte_Art._15a_B-VG_Schutzmassnahmen_betreffend_Kleinfeuerungen__1995-98_.pdf
[27] http://www.bmu.de/service/publikationen/downloads/details/artikel/verordnung-ueber-kleine-und-mittlere-feuerungsanlagen-1-bimschv/

Table 6. German authorities' requirements (Stufe 1 and Stufe 2), tested in accordance with EN15250 heat-accumulating stoves, EN14785 pellet stoves and EN13240 wood-burning stoves

Stufe 1, valid until 31/12-2014			
	Heat-accumulating stoves	**Pellet stoves**	**Wood-burning stoves**
Efficiency	$\geq$ 75%	$\geq$ 85%	$\geq$ 73%
CO	$\leq$ 2000 mg/Nm^3	$\leq$ 400 mg/Nm^3	$\leq$ 2000 mg/Nm^3
Particles	$\leq$ 100 mg/Nm^3	$\leq$ 50 mg/Nm^3	$\leq$ 100 mg/Nm^3
Stufe 2, valid after 31/12-2014			
Efficiency	$\geq$ 75%	$\geq$ 85%	$\geq$ 73%
CO	$\leq$ 1250 mg/Nm^3	$\leq$ 250 mg/Nm^3	$\leq$ 1250 mg/Nm^3
Particles	$\leq$ 40 mg/Nm^3	$\leq$ 30 mg/Nm^3	$\leq$ 40 mg/Nm^3

4.4.7 Special national official requirements in the Nordic region

Denmark:

Order no. 1432 of 11/12/2007[28] on the regulation of air pollution from wood-burning stoves and boilers and certain other fixed installations for energy production. The Order lays down regulations for the testing prior to sale, transfer or connection of combustion plant with a total thermal input below 300 kW. The municipalities are able to make requirements of combustion plant if the air pollution from wood-burning stoves, etc. is assessed to be significant, cf. Section 42 of the Danish Environmental Protection Act (Consolidated Act no. 879 of 26 June 2010).

Table 7. Space heaters with and without boilers must fulfil at least one of the following emission requirements for particles

Emission requirement (top limit) for particles	**Measurement principle**	**Testing method**
10 g/kg, and a maximum emission of 20 g/kg in the individual testing intervals	Dilution tunnel	NS 3058-1 and NS 3058-2 (calculated according to NS 3059, class 1 or 2, depending on the size of the combustion plant) or an equivalent standard for measurement of particle emissions recog-nised in the EU, EFTA countries or Turkey.
75 mg/normal m^3 at 13% O_2	Direct in the flue gas duct	Measurement method in accordance with DIN+, Zertifizierungsprogramm, Kaminöfen für feste Brennstoffe mit schadstoffarmer Verbrennung nach DIN EN 13240, or equivalent standard for measurement of particle emissions recognised in the EU, EFTA countries or Turkey.

Draft new revised Executive Order no. 1432 of 11/12/2007[29] was sent for consultation in December 2012 with the following emission limits:

[28] https://www.retsinformation.dk/Forms/R0710.aspx?id=105319
[29] http://www.mst.dk/Virksomhed_og_myndighed/Luft/Luft+nyheder/Nye_krav_til_braendeovne.htm

Table 8. Revised consultation proposal for space heaters with and without boilers that must comply with at least one of the following emission requirements for particles. Date of entry into force not yet determined

Emission requirement		Measurement principle	Testing method
Dust (particles)	**OGC**		
5 g/kg, and a maximum emission of 10 g/kg in the individual testing intervals	150 mg/m^3 at 13% O_2	Dilution tunnel	NS 3058-1 and NS 3058-2 (calculated according toNS 3059, class 1 or 2, depending on the size of the combustion plant) or an equivalent standard for measurement of particle emissions recognised in the EU, EFTA countries or Turkey.
40 mg/normal m^3 at 13% O_2	100 mg/m^3 at 13% O_2	Direct in the flue gas duct	Measurement method in accordance with DIN+, Zertifizierungsprogramm, Kaminöfen für feste Brennstoffe mit schadstoffarmer Verbrennung nach DIN EN 13240, etc. depending on plant type or equivalent standard for measurement of particle emissions recognised in the EU, EFTA countries or Turkey.

Table 9. As from 1 July 2016 space heaters with and without boilers must fulfil the emission requirements for at least one of the following testing methods

Emission requirement		Measurement principle	Testing method
Dust	**OGC**		
4 g/kg, and a maximum emission of 8 g/kg in the individual testing intervals	120 mg/m^3 at 13% O_2	Dilution tunnel	NS 3058-1 and NS 3058-2 (calculated according to NS 3059, class 1 or 2, depending on the size of the combustion plant) or an equivalent standard for measurement of particle emissions recognised in the EU, EFTA countries or Turkey.
30 mg/normal m^3 at 13% O_2	80 mg/m^3 at 13% O_2	Direct in the flue gas duct	Measurement method in accordance with DIN+, Zertifizierungsprogramm, Kaminöfen für feste Brennstoffe mit schadstoffarmer Verbrennung nach DIN EN 13240, etc. depending on plant type or equivalent standard for measurement of particle emissions recognised in the EU, EFTA countries or Turkey.

In the draft new revised Executive Order no. 1432 of 11/12/2007 there are proposals for specific requirements of chimney heights on the establishment of new chimneys and combustion plant. These minimum heights for new chimneys and combustion plant are stated in the Executive Order and exemplified in Appendix 3 of the Executive Order. The municipalities inspect compliance with these requirements. The background to the requirement is that the smoke can spread in the garden or to neighbours if the chimney is not high enough.

Tax on firewood and wood pellets

Denmark: Based on the energy policy proposal "Our Energy", in 2013 the Danish government will commence the planning of a tax on biomass for space heating, including firewood and wood pellets[30]. The tax will be a "supply reliability tax" to compensate for the loss of income to the State on a decline in the use of tax-liable fossil fuels to heat homes. The details of the tax are not yet known, but according to the political proposal

[30] http://www.trae.dk/index.asp?page=/Dokumenter/Dokument.asp%3FDokumentID%3D1580

the tax on the firewood will be DKK 27.40 per GJ heat from firewood for wood-burning stoves. According to DAPO, the Association of Danish Suppliers of Open Fires and Wood-Burning Stoves, this will correspond to a cubic metre of deciduous wood, depending on the nature of the wood, being subject to tax of DKK 160-170. According to the Danish Energy Agency, the bill for the supply reliability tax will be tabled in the spring of 2013, and the tax will be planned to enter into force in 2014 and phased in up to 2020.

The environmental organisation "Det Økologisk RÅD" (the Organic COUNCIL) (DØR) wishes to change the tax on firewood to a tax on wood burning that is an incentive for cleaner heating[31]. DØRs proposals aims to tax the heavy particle pollution from wood burning, based on the number of operating hours, but differentiated by the heating device contamination.

The proposed supply charge tax was taken permanently off the table in April 2014[32].

Norway: In Norway there are official requirements for emissions of particles (SBE 2007, Section 8-51) from closed fireplaces (wood-burning stoves, pellet stoves, tiled stoves, etc.).

Table 10. Norwegian authorities' requirements of closed fireplaces

Closed fireplaces	Particles, mean value	Testing method
Stove with catalytic converter	5 g/kg fuel (mean value for up to four loads)	NS 3058, NS3059
Stove with another technology	10 g/kg fuel (each individual load)	NS 3058, NS3059

The Directorate for Construction Quality (DiBK) is the central construction authority, while the municipality is the local construction authority. One of DiBK's key tasks is to inform and guide the municipalities and the construction industry concerning the building regulations. DiBK is responsible for drawing up new building regulations and is responsible for drawing up technical regulations for the Planning and Construction Act (TEK). The municipalities are the inspection authority and must contribute to ensuring compliance with the acts from DiBK.

The requirements for wood-fired stoves are specified in TEK 10, which is the legislation in force as of March 2013. One of the sections of TEK 10, Section 9-10, applies to emission requirements of wood-burning stoves, etc. and this section refers to the current Norwegian Standard NS 3059. The weighted average emission of particles is measured in accordance with the standard and is set at 5 and 10 g/kg for fireplaces with and without catalytic converters, respectively. Catalytic converters are weakened over time and may be damaged by incorrect use. The requirement in NS 3059 catalytic heaters is therefore twice as strict. A distinction is made in the requirements between fireplaces that burn cleanly at low load - lowest wood consumption below 0.8 kg/hour (class 1) and below 1.25 kg/hour (class 2)[33].

In TEK 10 > Section 15-1, general requirements of heating and cooling installations, requirements are made of the building in which fireplaces are installed: "In normal operating conditions there must be good combustion. The installation must have the

[31] http://www.ecocouncil.dk/index.php?option=com_content&view=article&id=1537:pressemeddelelse-afgift-pa-braendefyring-skal-sikre-ren-luft-i-villaomrader&catid=33:trafik-og-luft&Itemid=93
[32] http://www.skovforeningen.dk/site/nyheder/2135/
[33] http://www.ssb.no/a/publikasjoner/pdf/rapp_200136/rapp_200136.pdf Visited 5 March 2013

necessary intake of air for combustion. A smoke flue must be connected unless it is documented that such connection is not necessary. The installation must have an acceptable flue gas temperature." The guideline refers specifically to NS-EN 13240 and NS 3058/59.

In a supplement Norway also makes REQUIREMENTS of the documentation of environmental characteristics, i.e. particle emissions in accordance with NS 3059. In TEK 10 > Section 15-3 requirements of smoke flues and chimney are described.

It should be stated that in Norway, as from January 2013, there is a requirement of independent inspection in action class 2 and 3 of pre-project design for, among other things, fire safety strategy/concept for new construction and full renovation.

Sweden: Sweden's national environmental work is based on 16 environmental quality objectives in different areas. Small-scale combustion of biofuel primarily affects the environmental objective for Fresh Air, where small scale wood burning is stated as one of the reasons that the objective is assessed to be difficult to fulfil.

Environmental quality objectives for "Environmentally sound construction", "Limited climate impact" and "Living forests" are also affected to varying degrees by the small-scale combustion of solid biofuel. The Fresh Air objective has sub-objectives for six air regulations[34], where the combustion of wood is stated to be part of or the main reason that the sub-objective for particles and benzo(a)pyrene are difficult to meet[35].

Environmental quality norms are a legally binding control instrument that was introduced with the Environmental Act in 1999. They are based on various EU directives such as 2008/50/EC and 2004/107/EC. The norms are legally binding and the purpose is to guarantee citizens the lowest acceptable level of various types of air pollution. The norms affected by small-scale combustion of biofuel are shown in the table below.

Table 11. Threshold value for the air pollution where combustion of wood is stated to be a strong contributory factor. The threshold values are laid down in Swedish legislation (Order on Air Quality SFS 2010:477)

Regulation	Threshold value	Comment
Particles (PM10)	50 µg/m^3, daily average value (may be exceeded 25 times per year) 40 µg/m^3, annual average value	May not be exceeded.
Particles (PM2,5)	25 µg/m^3, annual average value	Must be sought to achieve compliance by 31 December 2014. May not be exceeded thereafter
Benzo(a)pyrene	1 ng/m^3	Must be sought to achieve compliance as from 1 January 2013.

Within the framework of the Swedish BHM (Biobränslen-Hälsa-Miljö)[36] research programme, measurements have shown that even small detached home areas can find it difficult to comply with current environmental quality standards, especially with regard to

[34] Sulphur dioxide, nitric oxide, tropospheric ozone, volatile organic compounds, particles and benzo(a)pyrene.
[35] Environmental Objectives Council, 2010. http://www.miljomal.se/sv/Publikationer-och-bilder/Rapporter/Miljomalsradet/Miljomalen--i-halvtid/
The Environmental Objectives Council was set up in 2002 and was responsible for assessing the work and reporting on the development of the national environmental quality objectives to the Swedish government. Since 2010 this responsibility has been held by the Swedish Environmental Protection Agency.
[36] Methods to assess the impact on air quality of local wood burning, Experience from BHM. ITM report 118, ITM Air Laboratory, University of Stockholm http://www.itm.su.se/reflabmatningar/dokument/itm_rapp118_2003-12-10.pdf

particles. The reason is stated to be the combustion of wood in old wood-burning stoves/boilers.

Today, several municipalities have an action plan[37] because they exceed the norms for either NO_2 or particles. In these cases, traffic is stated to be the main reason for the high measurements. Besides emissions from road traffic, burning wood in wood-burning stoves and small boilers is a key contributing factor.

The Swedish National Board of Housing, Building and Planning's Building Regulations (BBR) set requirements of fire safety, installation and emissions (installation of fireplaces, chapter 5, emissions, chapter 6 (6:741)).

Table 12. Highest permitted value for emissions of CO and minimum efficiency requirement in accordance with the Swedish National Board of Housing, Building and Planning's Building Regulations 6:7411. Test in accordance with SS-EN 12815, SS-EN 13229, SS-EN 12809, SS-EN 13240 and SS-EN 14785. The requirement concerning CO emissions does not apply to open fireplaces, tiled stoves and wood-burning hobs

	CO vol.%, at 13% O_2	Efficiency
Wood-burning stoves, etc.	0.3%	Min 60%
Inset fireplaces	0.3%	Min 50%
Pellet stove	0.04%	Min 70%

Finland: In Finland, there is no national environmental legislation for wood-burning stoves and similar products. Environmental legislation follows the EU's environmental requirements.

4.5 Other labelling schemes and instruments

This chapter describes four other labelling schemes that set requirements for emissions and efficiency as the key parameters: the P-mark quality label, the German Din+, the German Der Blaue Engel and the Austrian Ummwelzeichen ecolabel. There are various standards to measure emissions and they vary in terms of whether measurements are to be performed at nominal load, or low load, or both. It is most common for measurements to be performed at 13% O_2, and this is specified in some cases. Version 3 of the Nordic Ecolabel sets requirements for emissions of CO, OGC and particles, and also of efficiency. Der Blaue Engel, Din+ and Ummweltzeichen set further NOx requirements. An overview of requirements of measurement method, emissions and efficiency can be found in Appendix 2.

4.5.1 P-mark

The P mark is a voluntary labelling scheme undertaken by SP Technical Research Institute of Sweden. On SP's own website, [38]the labelling scheme is described as follows: "The P-Mark means that the product meets legal or regulatory requirements, but in most cases it also means that it meets other, more stringent requirements demanded by the market. P-marking means that the product is type-tested and that the manufacturer's own inspection is monitored by SP. Today, six manufacturers have opted for P marking of their stoves. There are also

[37] Small-scale combustion of solid biofuel, ER 2010:44. Swedish Energy Agency, 2010.
[38] http://www.sp.se/sv/index/services/p_mark/Sidor/default.aspx (visited on 14 March 2013)

P-marked pellet stoves. The P-marking requirements for stoves have not been revised since 2002. The following requirements must be fulfilled:

Table 13. Emission requirements for P-marking of stoves

	Wood-burning stoves: (13% O_2) EN13240	**Pellet stoves: (13% O_2) EN14785 (SP2453)**
CO	0.3%/3750 mg/m^3	1455 mg/m^3
OGC	< 200 mg/m^3 (CEN/TS 15883, SP1695)	55 mg/m^3 (CEN/TS 15883, SP1695)
Particles	Each sub-load < 100 mg/m^3	Each sub-load < 100 mg/m^3
Efficiency	> 70%	Min 75% at 3-5 kW

The P-marking requirements (SPCR 134) concern wood-fired local fireplaces such as wood-burning stoves, inset fireplaces, tiled stoves and kitchen stoves. The regulations also concern local fireplaces that heat water and not heavy heat-accumulating stoves (tiled stoves). The regulations do not concern the actual smoke flue system besides pipes between stove and chimney if this is delivered with the stoves to provide space heating. Besides emission requirements in the above table, the requirements of P-marked fire-places include requirements of construction, safety, technical documentation and instructions for installation and use, as well as quality assurance of the production process.

The regulations for pellet stoves (SPCR 093) with a stated output of maximum 15kW. The regulations also include pellet stoves with heating of water. The regulations do not include external fuel transport systems from any separate fuel room. The smoke flue is not subject to the regulations.

The requirements of CO, OGC, particles and efficiency lie below the Nordic Ecolabel's equivalent requirements of wood-burning stoves and pellet stoves (except for the requirement concerning OGC for pellet stoves, which is tighter than the Nordic Ecolabel's requirement).

4.5.2 DIN+

Din+ is a German quality label developed by DIN CERTCO[39]. The tested, certified and monitored product quality is represented by the internationally recognised, neutral quality label: DIN plus. Manufacturers may also show how their products have quality characteristics that exceed the standards using the ”DIN +” quality label. DIN+ certification shows that stoves are environment-friendly, with especially low emissions. The stoves are tested in accordance with DIN EN13240 at 13% O_2. Like the Nordic Ecolabel, Din+ sets requirements of emission threshold values for carbon monoxide, (NOx), hydrocarbons and dust, as well as efficiency. There are also requirements for nitrogen oxides. The CO requirement is tighter than the Nordic Ecolabel's equivalent requirement. As from 31/12-2014, the efficiency requirement will also be tighter than the Nordic Ecolabel's current requirement, version 3, of 75%. Requirements are also made of the fireplace's

39 http://www.dincertco.de/en/wood_burning_stoves_wood_pellet_stoves_cartridge_heaters_stoves_and_other_domestic_heaters.html

quality. A routine test is performed every 2-5 years in order to confirm that the products have retained a high quality standard. The following requirements must be fulfilled:

Table 14. Emission and efficiency requirements for DIN+ labelling of wood-burning stoves/inset fireplaces

	Before 31.12.2014	After 31.12.2014
CO	≤ 1500 mg/Nm^3 (≤ 0.12%)	≤ 1500 mg/Nm^3 (≤ 0.12%)
OGC	≤ 120 mg/Nm^3	≤ 120 mg/Nm^3
Particles	≤ 75 mg/Nm^3	≤ 40 mg/Nm^3
NOx	≤ 200 mg/Nm^3	≤ 200 mg/Nm^3
Efficiency	≥ 75% (intermittent use) ≥ 73% (continuous use)	≥ 78% (intermittent use) ≥ 73% (continuous use)

DIN+ also sets requirements for pellet stoves, which are tested in accordance with DIN EN14785 at 13% O_2 as well as heat-accumulating stoves tested in accordance with Din EN15250 at 13% O_2. The requirement of CO, CnHm (equivalent to OGC) and efficiency is tighter than the Nordic Ecolabel requirement of pellet stoves. The requirements of heat-accumulating stoves all lie below the equivalent Nordic Ecolabel requirements. The Nordic Ecolabel does not set emission requirements for NOx, as this parameter is to a high degree fuel-dependent.

Table 15. Emission and efficiency requirements for DIN+ labelling of pellet stoves and heataccumulating stoves

	Pellet stoves	Heat-accumulating stoves
Test basis	DIN EN14785	DIN EN15250
CO	≤ 200 mg/Nm^3	≤ 1500 mg/Nm^3
CnHm	≤ 10mg/Nm^3	≤ 120 mg/Nm^3
Particles	≤ 25 mg/Nm^3	≤ 75 mg/Nm^3
NOx	-	≤ 200 mg/Nm^3
Efficiency	≥ 90%	≥ 75%

4.5.3 Der Blaue Engel

The criteria to mark a pellet stove with the ecolabel "Der Blaue Engel" are named Wood Pellets Stoves RAL-UZ 111[40]. Today, seven manufacturers hold Der Blaue Engel for a number of pellet stoves. None of these are Nordic Ecolabelled.

Like the Nordic Ecolabelling criteria, Der Blaue Engel sets requirements of CO, OGC, particles and efficiency, which are tested at several loads. Der Blaue Engel sets further requirements for NOx. The requirements of emissions and efficiency are tighter than the Nordic Ecolabel requirements (version 3).

Table 16. Der Blaue Engel's emission and efficiency requirements for pellet stoves, tested in accordance with DIN 18894 (EN14785)

	Nominal load	Low load
Efficiency	≥ 90%	≥ 90%
NOx	≤ 150 mg/Nm^3	
CO	≤ 180 mg/Nm^3	≤ 400 mg/Nm^3

[40] http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=218

OGC	≤ 10 mg/Nm^3	≤ 15 mg/Nm^3
Particles	≤ 25 mg/Nm^3	-

4.5.4 Umweltzeichen 37 in Austria

The criteria for the Austrian ecolabel are called the Austrian Umweltzeichen 37, wood-fired stoves [41](holzheizungen). Today, 20 manufacturers hold licences for a number of wood-burning stoves and inset fireplaces, while 13 hold licences for a number of pellet stoves[42]. None of these hold Nordic Ecolabel licences. Like the Nordic Ecolabelling criteria, the Austrian ecolabel sets requirements of CO, OGC, particles and efficiency, which are tested at several loads. The label also sets requirements for emissions of NOx. The requirements of CO, OGC and efficiency are tighter than the Nordic Ecolabel's equivalent requirements (version 3).

Table 17. The Austrian ecolabel Umweltzeichen 37's emission and efficiency requirements for pellet stoves, tested in accordance with EN14785

Automatically fed fireplace	Nominal load	Low load
Efficiency	≥ 90%	-
NOx	≤ 100 mg/MJ (≈150 mg/Nm^3)	
CO	≤ 120 mg/MJ (≈180 mg/Nm^3)	≤ 265 mg/MJ (≈397 mg/Nm^3)
OGC	≤ 6 mg/MJ (≈9 mg/Nm^3)	≤ 10 mg/MJ (≈15 mg/Nm^3)
Particles	≤ 20 mg/MJ (≈30 mg/Nm^3)	-

Table 18. The Austrian ecolabel Umweltzeichen 37's emission and efficiency requirements for wood-burning stoves and inset fireplaces, tested in accordance with EN13240

Manually fed fireplaces	Nominal load
Efficiency	≥ 80%
NOx	≤ 120 mg/MJ (≈180 mg/Nm^3)
CO	≤ 700 mg/MJ (≈1050 mg/Nm^3)
OGC	≤ 50 mg/MJ (≈75 mg/Nm^3)
Particles	≤ 30 mg/MJ (≈45 mg/Nm^3)

5 About the criteria revision

Purpose of the criteria revision

Nordic Ecolabelled closed fireplaces are designed to burn solid biofuels, ie. wood, wood pellets or other biomass fuels. Combustion of biomass has an effect on the climate and are therefore not climate neutral. The advantage of the combustion of biomass is that it does not add more CO_2 to the climate system, as is the case with fossil fuels. The uptake of CO_2 from biofuels is also much faster than from fossil sources. Biofuel has a relatively

[41] http://www.umweltzeichen.at/richtlinien/Uz37_R5a_Holzheizungen_2012.pdf
[42] http://www.umweltzeichen.at/cms/home/produkte/gruene-energie/content.html?rl=26

short-lived climate impact compared to fossil CO_2, the exposure lasts for several thousand years[43].

Combustion of biomass contribute to emissions of, among other things, particles, volatile hydrocarbons (OGC), carbon monoxide (CO), NOx and Carbon Black. It is therefore important that increased combustion of biofuel does not increase emissions to the air and derived health effects.

Closed fireplaces for combustion of solid biofuel are an alternative to local heating of houses and summer cottages, but can also be used in larger venues such as hotels (comfort heating).

Life cycle analyses[44],[45],[46] show that the largest element of the environmental impact occurs during operation of the fireplace, i.e. as emissions. The Norwegian study has considered "input-output" data where the main components was the production of birchwood (forestry and felling, transport, cutting and transport to the consumer), and the production and operation of wood-burning stoves. The results show that the operational phase represents more than 60% of the environmental impacts.

Emission and efficiency data from licence holders shows that it is possible to tighten the Nordic Ecolabel's current requirements of particles, CO, OGC and efficiency. Tighter national legislation for emissions from fireplaces in both Germany and Denmark, as well as the development of ecodesign and energy labelling regulations for local closed fireplaces emphasises a need for revision of the criteria, so that Nordic Ecolabelled fireplaces still exceed the legislative requirements for these important parameters.

Evaluation of today's criteria for Nordic Ecolabelled closed fireplaces version 3 (spring 2013) resulted in a proposal to revise the criteria, primarily by tightening the present emission requirement limits, as well as efficiency requirements.

Based on recommendations from the evaluation report, the revision has the following objectives:

- Tighten the requirement for emissions to air of emissions that are hazardous to the environment and health. Emission and efficiency data from Nordic Ecolabelled licence holders (Appendix 1) show that several stoves are far below the Nordic Ecolabel's current requirement limits.
- Consider the opportunity to tighten the efficiency requirement.
- Consider the efficiency requirement. It should be assessed whether the Nordic Ecolabel should instead require seasonal space heating energy efficiency equivalent to the current EU energy labelling regulation (LOT 15) for local closed fireplaces.
- Consider the opportunity to make requirements of new technologies that can improve the closed fireplace's combustion such as automatic combustion control, electronic control of the stove, post-burners or flue gas purification.

[43] http://www.cicero.uio.no/fulltext/index_e.aspx?id=8878
[44] Bowyer Jim: Life Cycle Impacts of Heating with Wood in Scenarios Ranging from Home and Institutional Heating to Community Scale District Heating Systems. Dovetail Partners inc., 2012
[45] Solli, Chr. et al. "Life Cycle Assessment of Wood Based Heating in Norway" Int J Life Cycle Assess (2009) 14:517–528
[46] Cleaner Product Development Based on Life Cycle Assessment: Lithuanian Experience", Jurgis Staniskis, Visvaldas Varzinskas, Institute of Environmental Engineering (APINI), Kaunas University of Technology, 2005

- Consider the opportunity to require the use of water-based surface treatment, possibly by tightening requirements of CMR-classified chemical products.
- Consider the opportunity to make requirements of the surfacing of stone and stone production.
- Consider the opportunities to make requirements of the durability of the combustion chamber (requirements of the thickness of steel panels) and the durability requirements of the entire stove (guarantee).
- Consider requirements of test methods.
- Update information to customers and requirements of distributors and installation technicians.

About this criteria revision

The revision is undertaken by product group officer (PA) Thomas Christensen (DK) as project manager and Harri Hotuleinen (Fin) as project adviser (PR). Mogens Stibolt (DK), Ola Rise (N), Björn Simons (S) and Elina Ojala (Fin) are national contact persons (NCP).

6 Justification of the requirements

In this chapter the requirements concerning the manufacture of closed fireplaces are described.

6.1 Introduction to the materials requirements

The materials used in closed fireplaces for solid biofuel are cast iron, steel/iron, stone, tiles, glass and insulation and sealing material. Plastic is rarely used, and any use is on a small scale. Metals may be surface-treated with paint, varnish or coatings such as chromium and nickel. Glass is a prominent element of especially wood-burning stoves and inset fireplaces, and the glass contains boron, for example. Insulation is used in small volumes (by weight) in stove doors and in connection to smoke flues. Ceramic, silicate and other special materials are used in the panels to insulate the combustion chamber.

The report "Task 4: Technical analysis of existing products" which is background material to the LOT EuP directive,[47]compares different materials in different types of stove.

According to the report, closed fireplaces for solid biofuel that as a general rule are built from steel on average contain 72% steel, 22% stone, 6% cast iron, 1.2% glass and approximately 1% surface coating and sealing material. Stoves that are mainly built from cast iron contain an average of 91% cast iron, 5% steel, 2% stone/ceramic and below 1% glass and other material. Pellet stoves consist of 82% steel, 10% cast iron, 7% stone/ ceramic and less than 1% glass. This type of stove also includes less than 1% electronics.

Nordic Ecolabelling has considered introducing requirements of all of the types of materials used in the production of fireplaces, and of the production conditions. Appendix 3 presents an overview of several materials types and environmental issues

[47] Task 4 in the EuP directive on Solid Fuel Small Combustion Installations, (Lot 15). http://www.eceee.org/ecodesign/products/Lot_20_local__room_heating__products (16-9-2013)

considered in this revision, but which are not subject to Nordic Ecolabel requirements. This is due to either lack of relevance, controllability or potential.

6.2 Revised requirements and new requirements of materials

O1 Description of the production process

The production process for the Nordic Ecolabelled stove must be described.

The description must include the following:

- Name and contact details of:
  - production location(s) for final manufacture of stoves
  - subsuppliers of surface finishing and metal coating
  - subsuppliers of other components subject to the requirements
- A description of the production process for the stove stating the various process stages, including cleaning technique. Production technique and cleaning technique for surface finishing and metal coating must be stated.
- Copy of environmental licence/permit or inspection report from the environmental authority concerning final production, with details of emissions governed by the licence during the past year.

Final production of the stove does not apply to production of raw materials such as steel, glass or plastic elements. Production of cast iron is deemed to occur if the cast iron producer manufactures cast iron stoves. Cast iron parts for other stoves are not subject of the requirement.

✉ A description of the stove's production process according to the requirement. Copy of the environmental licence/permit or inspection report from the environmental inspection authority concerning final production, with details of emissions governed by the licence during the past year.

Background to the requirement:
Manufacturers of closed stoves for solid biofuel have experienced tougher competition in the existing markets. This has resulted in mergers and acquisitions of competitors, as well as the transfer of production to especially eastern Europe to an increasing extent. Today, Nordic Ecolabelling has licence holders that produce both semi-manufactures (such as combustion chambers, etc.) and complete stoves via subsuppliers in eastern Europe. In many cases, production is distributed on several subsuppliers. With this requirement, Nordic Ecolabelling ensures a full overview of the production processes and the subsuppliers involved.

Nordic Ecolabelling will have a description of the production process comprising the entire production flow (planning of production, technical drawings/purchasing of components, assembly of components, post-treatment (centrifugal cleaning/surface treatment), final assembly, storage and transport). Further documentation may consist of production diagrams presenting the individual production stages (with raw materials and semi-manufactures).

To get a better overview of the subsuppliers used for surface treatment, metal coating and production of other components (which are subject to the requirements), these must be stated by name and production location, as well as a description of what they produce.

Nordic Ecolabelling requires information on the environmental licences held by manufacturers for the production of stoves (final production) or control reports by the

relevant environmental authority, as well as licensed emissions during the past year. Experience from the requirement in the present criteria version 3 shows that there can be large national variations in which licensed emissions the individual production may be subject to. Emissions typically regulated are VOC, NOx and possibly wastewater.

O2 Material requirements

The manufacturer must draw up a list of all of the elements included in the closed fireplace, stating the type and material, as well as technical drawings with measurements.

Materials and construction must comply with relevant requirements in the current standard for the stove type in question, EN13240 or EN16510 (wood-burning stoves), EN13229 or EN16510 (inset fireplaces), EN14785 (pellet stoves), EN15250 (heat-accumulating stoves) or EN15821(sauna stoves). The requirement includes, for example, quality, thickness of materials, durability and permitted surface temperatures (safety) of materials.

A guarantee for materials and construction faults of at least five years must be given for the bearing structure (excluding the interior of the combustion chamber) on normal use.

☒ A description of materials for all of the elements included in the closed fireplace, as well as technical drawings with measurements approved by the test laboratories in connection with testing of the stove.

☒ Declaration from the manufacturer that the requirements of the materials and structure have been fulfilled. Appendix 2 may be used.

Background to the requirement:
The requirement ensures that Nordic Ecolabelling gains an overview of all materials used in the closed fireplace and that all elements are documented, so that it is easier to make relevant requirements of materials in connection with future revisions of the criteria. It has now been emphasised as the documentation requirement that the Nordic Ecolabel requires the materials description and the technical drawings approved by the test laboratories in conjunction with testing of the stoves. Submission of a full test report is already a requirement in today's criteria, cf. chapter 2. Lists of materials and technical drawings approved by the test laboratories are today an important element of the laboratories' control. Technical drawings approved by the test laboratories are also an important element of the Nordic Ecolabelling's inspection/post-inspection of licence holders.

The interior insulation panels in the combustion chamber are one of the spare parts that are purchased by customers. The panels are sold in both special packages designed for the individual fireplace or individually, whereby the customer cuts the panel to fit. The panels are, among other things, produced from a silicate material called Vermiculite[48]. The material is porous and does not withstand knocks or blows. Cracks are usually due to the material being knocked with a piece of wood or similar. This does not change the insulating effect for as long as the panels are still placed correctly in the wood-burning stove. The panels should be replaced when they are worn down to approximately half their thickness. After this, they can no longer provide optimum insulation and therefore cannot ensure the right combustion temperature, or protect the wood-burning stove from the high temperatures in the combustion chamber.

[48] "Das Industriemineral Vermiculit – Einfluß der Rohstoffmineralogie auf die Deund Rehydratation bei der Herstellung von Hochtemperaturdämmstoffen", Thomas Doege, Der Fakultät für Bergbau, Hüttenwesen und Geowissenschaften der Rheinisch-Westfälischen Technischen Hochschule Aachen.

Chamott is another type of material that absorbs heat, however, which can entail that it takes longer to achieve a high combustion temperature in the chamber. Another material is Termott, which is strong and has good insulation properties. In this version of the criteria, Nordic Ecolabelling has added information requirements in the operation and maintenance requirement (O19) concerning the importance of the correct position of the insulation panels in the fireplace, and that they should be replaced when they are worn down to approximately half their thickness.

Requirements of material and structure are stated in EN13240 or EN16510 (wood-burning stoves), EN14785 (pellet stoves), EN13229 or EN16510 (inset fireplaces), EN15250 (heat-accumulating stoves), EN15821 (sauna stoves), for example with requirements of the quality of materials, thickness of materials, durability of materials (but not insulation panels such as vermiculite), temperatures, fire safety and electrical safety. EN13240 and EN13229 are currently subject to revision and will be combine in a new EN16510 standard. A draft of the new revised standard is expected to be sent for consultation in 2014. Manufacturers of closed fireplaces must declare that materials fulfil the requirements laid down in the standard.

Nordic Ecolabelling has focus on quality and therefore requires the fireplace's manufacturer to provide a guarantee for material and construction faults for at least five years for the bearing structure (excluding the interior of the combustion chamber) on normal use. The guarantee must be stated in operating and maintenance instructions (O19). The exemption applies to the interior parts of the combustion chamber that are exposed to wear. Glass is also exempt from the requirement.

The reason that the manufacturer must declare that materials fulfil the requirements of the relevant standard is to ensure low environmental effects in the longer term. It is important to ensure that the quality of the fireplace does not deteriorate and that it fulfils the Nordic Ecolabelling requirements during the term of validity of the licence. The test laboratories' ongoing quality control helps to safeguard the quality of the fireplaces.

O3 Chemical products, classification

The manufacturer must draw up a list of the chemicals used in the final production (painting, installation and final inspection) of closed fireplaces and on surface treatment. Chemical products such as glue, sealant, cleaning/degreasing products, paints and varnish used in the final production of the fireplace and for surface finishing may not be classified according to the table below.

Final production of closed fireplaces does not apply to the production of raw materials such as steel, cast iron, glass or plastic elements.

Table 19. List of non-permitted classification of the final chemical compound used in the product, in accordance with the CLP regulation 1272/2008, or later

Signal word	Hazard phrase	Hazard description	Risk phrase
		Environmentally hazardous	
Warning, Aquatic acute 1	H400	N	R50
Warning, Aquatic chronic 1	H410	N	R50/53
Warning, Aquatic chronic 2	H411	N	R51/53
-, Aquatic chronic 3	H412	-	R52/53
-, Aquatic chronic 4	H413	-	R53
-, Ozone	EUH059/H420	N	R59

		Carcinogenic	
Hazardous, Carc. 1A or 1B	H350	T	R45 and/or
Hazardous, Carc. 1A or 1B	H350i	T	R49
Warning, Carc. 2	H351	Xn	R40
		Mutagenic	
Hazardous, Muta. 1A or 1B	H340	T	R46
Warning, Muta. 2	H341	Xn	R68
		Reprotoxic	
Hazardous, Repr. 1A or 1B	H360	T	R60
Hazardous, Repr. 1A or 1B	H360	T	R61
Warning, Repr. 2	H361	Xn	R62 and/or
Warning, Repr. 2	H361	Xn	R63
-	H362	-	R33
-	H362	-	R64
		Very toxic	
Hazardous, Acute Tox. 1 or 2	H330	Tx	R26
Hazardous, Acute Tox. 1	H310	Tx	R27
Hazardous, Acute Tox. 2	H300	Tx	R28 and/or
Hazardous, STOT SE 1	H370	Tx	R39
		Toxic	
Hazardous, Acute Tox. 2 or 3	H330 or H331	T	R23
Hazardous, Acute Tox. 3	H331	T	R24
Hazardous, Acute Tox. 3	H301	T	R25
Hazardous, STOT SE 1	H370	T	R39 and/or
Hazardous, STOT SE 1	H372	T	R48
		Sensitising	
Hazardous, Resp. Sens. 1	H334	Xn	R42
Warning, Skin sens. 1	H317	Xi	R43

The classification applies in accordance with the EU's dangerous substances directive 67/548/EC with subsequent amendments and adjustments, and/or CLP regulation 1272/2008 with subsequent amendments. During the transition period, i.e. up to 1 June 2015, classification in accordance with the EU's dangerous substances directive or the CLP regulation may be used. After the transition period, only classification in accordance with the CLP regulation will apply.

Metal coating of parts is exempt from the requirement. By metal coating of parts, requirement O5 must be fulfilled.

Paint/varnish for surface coating of closed fireplaces classified with R52/53 or H412 is exempt from the requirement, subject to the requirement that the product is applied in a closed system, with appropriate personal protective equipment in accordans the with the requirements for protection listed on safety data sheet.

Hardeners for paint/varnish, where the hardener is classified with R43 or H317 are also exempt from the requirement. This exemption is, however, subject to the condition that adequate safety equipment is used when the hardener is mixed with the paint/varnish, and that the final two-component product (hardener+paint/varnish) is applied in a closed ventilated room.

✉ List of chemicals used in final production and for surface coating.

✉ Safety datasheet no less recent than three years for the final chemical compound used in the Nordic Ecolabelled product in accordance with Annex II of Reach (regulation 1907/2006/EC, with later amendments and additions).

✉ Routine for the use of safety equipment for use on mixing hardener with paint/varnish. Description of method to apply the final two-component product.

✉ Description of method to apply paint/varnish classified withR52/53 (H412).

Background to the requirement:
The requirement level for the classification of the chemical part of the product has been amended slightly in this revision.

The requirement is updated in accordance with CLP, which entails a new prohibition on the use of chemicals in final production with the risk clauses R53/R52 (aquatic chronic 3 with H412), R53 (Aquatic chronic 4 with H413), R33 (H362), R64 (H362) and clarification of the requirement text.

Nordic Ecolabelling seeks to ensure that the health and environmental impact of the products is as low as possible. Therefore prohibition requirements are made with specific requirements of the classification of the products. Requirements of chemicals (the product) will not prevent a product from containing substances with the undesired classification. But in such case, the classified substance is included as such a small amount that the final product is not classified.

The requirement of classification of chemical products in the present criteria (version 3) has meant that manufacturers have had to replace a number of chemical products due to CMR classification. This applies to glue, sealants (heat-resistant sealant, silicone), paint/varnish and cleaning/degreasing products.

On surface treatment of fireplaces, traditionally today paint/varnish is used that is classified as environmentally hazardous R52/53 (Aquatic chronic 3, H412). The development in surface treatment is for the use of water-based paint/varnish. Interviews with the industry show that in recent years most manufacturers have on an ongoing basis tested various water-based paints/varnishes in order to switch to this technique. The conclusion to the feedback from the industry is in part, however, that there are still a number of quality problems with the water-based technology, and that they therefore still use the traditional paints/varnished with a high proportion of solvents classified with R53/53. A typical quality problem for the water-based varnishes is that, once applied, the varnish very easily cracks when heating is repeated. It is, quite simply, hard for the varnish to adhere to the metal properly.

The reason[49] is that the water-based varnishes require clean metal surfaces (free of grease and oil) in order to adhere to the metal properly. Another element of the conclusion from the feedback from the industry is that restructuring of production to water-based varnishes is cost intensive, and that as yet there is no experience with the quality of the water-based varnish technology in the long term. Paint/varnish for surface treatment of closed fireplaces classified with R52/53 or H412 is to be exempt from the requirement (as in the present criteria version 3), subject to the condition that the product is applied in a closed ventilated room, with appropriate personal protective equipment in accordans the with the requirements for protection listed on safety data sheet

The new water-based products are usually a two-component (hardener + paint/varnish) where the component chemical product has no classification. The product does not contain any VOC either, which gives a major environmental/health benefit. The hardener is, however, classified as allergenic with R43 (H317) So that these water-based paints/varnishes can be used in the Nordic Ecolabelled fireplaces, in September 2012 an exemption was added to O3 for hardener classified with R43 (H317). This exemption is, however, subject to the condition that adequate safety equipment is used when the hardener is mixed with the paint/varnish, and that the final two-component product (hardener+paint/varnish) is applied in a closed system.

[49] Telephone conversation 23/9-2013 with Thomas Holdorf of Skanwib ApS - distributor of varnishes from Weilburger Coatings GmbH.

Nordic Ecolabelling wishes to maintain the development towards water-based varnishes and therefore the requirement for the exemption of hardener classified as R43 is unchanged in this revision.

The requirement of chemical products solely concerns chemicals used in final production (painting, assembly and final inspection) and for surface treatment. This is because it can be very difficult for the manufacturer of fireplaces to get information from all subsuppliers (for example approximately 20 suppliers) on which chemical substances have been used in raw materials production. Manufacturers of fireplaces can, on the other hand, control their own production.

Chemical products including degreasing agents and paint/varnish (in the painting process), glue, sealants (silicone, heat-resistant sealant, other sealant), as well as cleaning/degreasing products in the assembly and final inspection process. Lubricants, anti-corrosives, drilling oil and oil spray are thus not subject to the requirement.

O4 Component substances in chemical products

The following substances may not be included in the chemical products (for example glue, sealant, cleaning/degreasing products, paint and varnish) used in the final production of the fireplace and for exterior treatment:

- lead (Pb), mercury (Hg), chromium IV (CrIV), cadmium (Cd) and compounds thereof
- halogenated organic compounds
- alkylphenols, alkylphenol ethoxylates or other substances that can build alkylphenols or alkylphenol ethoxylates
- phthalates
- substances on the EU's candidate list in accordance with REACH, 1907/2006/EC article 59, paragraph 10 on the website of the European Chemicals Agency (ECHA). In the background document there is a link to the list.
- nanoparticles (from nanomaterials*)

The following are exempted from the requirement to nanoparticles:

- Pigments**
- Naturally occurring inorganic fillers***
- Synthetic amorphous silica***
- Polymer dispersions

** The definition of nanomaterials follows the European Commission's definition from 18 October 2011 (2011/696/EU): "A nanomaterial is a natural, incidental or purposely manufactured material containing particles, in an unbound state or as an aggregate or as an agglomerate and where, for at least 50% of the particles in the number size distribution, one or more external dimensions is in the size range 1-100 nm."*

*** Nano-titanium dioxide (nano-TiO_2) is not considered a pigment and is therefore covered by this requirement.*

**** This applies to fillers covered by appendix V point 7 in REACH.*

***** This applies to traditional synthetic amorphous silica. Chemically modified colloidal silica can be included in the products as long as the silica particles form aggregates in the final product. The surface treatment of surface-treated nanoparticles must fulfil requirement to component substances in chemical products.*

There is exemption from the list for metal coating of parts. On metal coating of parts, requirement O5 must be fulfilled.

The following definition must be used concerning "included": Ingoing substances are defined as, unless stated otherwise, all substances in the product – including additives (e.g. preservatives or stabilisers) in the raw materials, but not residuals from the production, incl. the production of raw materials.
Residuals from production , incl. production of raw materials are defined as residuals, pollutants and

contaminants derived from the production, incl. production of the raw materials, which are present in the final product in amounts less than 100 ppm (0.0100 w/w %, 100 mg/kg), but not substances added to the raw materials or product intentionally and with a purpose – regardless of amount. Residuals in the raw materials above 1.0% are regarded as ingoing substances. Known substances released from ingoing substances are also regarded as ingoing substances.

✉ Declaration or other equivalent documentation from the chemicals producer/supplier. Appendix 3 may be used.

Background to the requirement:
The requirement was also included in the previous version of the criteria. In this version, the requirement is tightened a little, however, so that a further substance group may not be actively added to the chemical products used in the final production of the fireplace and for exterior treatment. The new substance group is nanoparticles. In addition, substances on the EU's candidate list may not be included in the chemical products used in the final production of the fireplace or for surface treatment.

Heavy metals and their compounds.
The substances in question are lead, mercury, chromium IV and cadmium. The requirement especially concerns heavy metals that are detrimental to the environment and health that are specified in the text. These are toxic for human beings and other organisms. Heavy metals are a burden on the environment, so it is important to reduce discharges as far as possible. It is therefore relevant to ensure that substances added to the chemical products used in final production do not contain heavy metals such as mercury, chromium IV, lead or cadmium.

Halogenated organic compounds:
Halogenated organic compounds are organic compounds that contain halogenated compounds such as chlorine, bromine, fluoride or iodine. Halogenated organic compounds comprise many substances that are hazardous for the environment and health.

They are highly toxic for aquatic organisms and are also carcinogenic or hazardous to health in other respects. It is very hard to break down the halogenated organic compounds, which increases the risk of hazardous effects of the substances. The requirement entails, among other things, that halogenated flame retardants, chlorinated paraffins, perfluoroalkyl compounds (such as PFOA and PFOS) and halogenated organic compounds may not be added.

Alkylphenol ethoxylates (APEO) and alkylphenol derivatives (APD):
APEO and APD (background): Alkylphenol ethoxylates (APEO) are excluded because their degradation products are not easily degradable, and some degradation products are declared by the EU to be endocrine disrupters (such as nonylphenol). Alkylphenol derivatives (APD) are substances derived from APEO and excluded because they are hazardous to health or are not easily degradable. APEO and APD are on the List of Undesirable Substances and the basis for this is: "Nonylphenol, octylphenol and nonylphenol ethoxylate are on the EU's priority list of substances that must be investigated further for endocrine disrupting characteristics. Some octylphenol compounds have problematic characteristics in accordance with the Indicative List for Self-Classification. N; R50/53 and one compound also have R43.

The substances are only partly subject to application limitation, but other applications are also considered to be environmentally questionable."

Phthalates:
Many phthalate compounds have undesirable health and environmental effects. A number of phthalates are on the EU's priority list of substances that are to be investigated further for endocrine-disrupting effects - and for a number these effects have already been found. Phthalates are also the subject of considerable media attention and may therefore, for many reasons, be undesirable in environmentally labelled products. Some phthalates are on the list of List of Undesirable Substances, and these are diethylhexyl phthalate (DEHP), dibutyl phthalate (DBP), benzyl butyl phtalate (BBP), dimethoxyethyl phthalate (DMEP) and diisobutyl phtalate (DiNP) on the following grounds: "All five phthalates have problematic characteristics in terms of the List of Undesirable Substances. In addition, DEHP, DBP and BBP are on the EU's priority list of substances to be investigated further for endocrine-disrupting characteristics."

Nano:
Nanotechnology, which also includes nanoparticles, is increasingly used in the construction and interior design industry. Giving most grounds for concern is the use of nanoparticles that can be released and thereby affect both health and the environment. Nanoparticles can, for example, penetrate fresh cells where they can damage cells, or their DNS in the cell nucleus. Nano-level particles have special characteristics and are increasingly use in various consumer products such as paint and coatings. Nanoparticles may also present undesired risks to health and the environment. The particle form makes it possible, for example, to reach parts of the body or environments that are otherwise usually protected[50]. In addition, their size can lead to increased reactivity, since in relative terms small structures will have a far larger available surface compared with larger particles.

Research of the risk of using nanomaterials has focused mainly on health effects, and some cases adverse effects have been shown[51]. It has been shown, for example, that nanoparticles may penetrate cells and damage them[52]. This does not mean that all nanoparticles will have adverse effects. Today there is a lack of knowledge of the health and environmental effects of nanoparticles, especially the long-term effects[53]. Nordic Ecolabelling applies the precautionary principle to the use of nanomaterial.

Candidate list substances:
The use of candidate list substances in the chemical compound is prohibited. In article 57, REACH defines the criteria for assessment when substances are assessed to be particularly problematic, Substances of Very High Concern (SVHC). These substances may be included in the candidate list. There is no list of SVHC substances. Only a set of criteria for when substances are considered to be VHC. The inclusion of a substance on the candidate list does not have any regulatory consequences in itself, but indicates that the substance may be included on the Approved List (see below).

The candidate list is published in accordance with article 59 of REACH on the website of the European Chemicals Agency (ECHA). Here is a link to the list:
http://echa.europa.eu/candidate-list-

[50] The Danish Board of Technology, 2008: Nanomaterials, risk and regulation, report 2008
[51] The Danish Board of Technology, 2008: Nanomaterials, risk and regulation, report 2008
[52] Janne K. Folkmann, Lotte Risom, Nicklas R. Jacobsen, Håkan Wallin, Steffen Loft, Peter Møller; Oxidatively Damaged DNA in Rats Exposed by Oral Gavage to C60 Fullerenes and Single-Walled Carbon Nanotubes, Environ. Health Persp, 117(5), 2009
[53] Janne K. Folkmann, Lotte Risom, Nicklas R. Jacobsen, Håkan Wallin, Steffen Loft, Peter Møller; Oxidatively Damaged DNA in Rats Exposed by Oral Gavage to C60 Fullerenes and Single-Walled Carbon Nanotubes, Environ. Health Persp, 117(5), 2009

table?p_p_id=substancetypelist_WAR_substanceportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_pos=2&p_p_col_count=3&_substancetypelist_WAR_substanceportlet_delta=75&_substancetypelist_WAR_substanceportlet_keywords=&_substancetypelist_WAR_substanceportlet_advancedSearch=false&_substancetypelist_WAR_substanceportlet_andOperator=true&_substancetypelist_WAR_substanceportlet_orderByCol=inclusiondatecl&_substancetypelist_WAR_substanceportlet_orderByType=desc&_substancetypelist_WAR_substanceportlet_cur=1

O5 Metal coating of parts

Parts of metal may not be coated with lead(Pb), mercury (Hg), cadmium (Cd), chromium VI (CrVI), nickel (Ni) or compounds thereof.

Exceptionally, parts may be coated with chromium III, nickel or compounds thereof in cases where this is necessary due to chemical or mechanical wear, or other documented special technical requirements.

Any chromium and nickel-plating processes must take place using cleaning techniques, ion-exchange techniques, membrane techniques or similar techniques, in order to be able to recover the metals to the greatest possible extent. Residual products from coating must be used for recovery schemes or waste handling. The system must be without a drainage system.

✉ Declaration from the manufacturer that the requirement for metal coating is fulfilled. Appendix 2 may be used.

✉ Report on any need for metal coating (only chromium VI (CrVI), nickel (Ni) or compounds thereof) from the fireplace's manufacturer. If metal coating is used report on which cleaning technique that have been used.

Background to the requirement:
The requirement was also included in the previous version of the criteria. Surface coating of metals has environmental impacts[54] (relevance). Substances that are hazardous to the environment and health are used in certain metal coatings, such as chromium coatings. When parts are metal coated, the environmental impact can vary, depending on the process used and the substances used for surface treatment (potential). Exceptionally, small parts (such as screws, discs and bolts) and surfaces may be chromium III or nickel-coated if this is required due to chemical or mechanical wear or other special technical requirements. The chromium- or nickel-coating of handles is not considered to be necessary on grounds of chemical or mechanical wear. Any chromium and nickel-plating processes must take place using cleaning techniques, ion-exchange techniques, membrane techniques or similar techniques, in order to be able to recover the metals to the greatest possible extent. Residual products from coating must be used for recovery schemes or waste handling. The system must be without a drainage system- Appendix 2 of the criteria document can be used by the manufacturer to document the requirement.

O6 Surface treatment and VOC content in the surface paint/-varnish

Surface treatment (manual/mechanical process) must take place in closed ventilated room with appropriate personal protective equipment. Similarly, the drying process is carried out in an closed ventilated room.

Products used for surface paint/-varnish must contain a maximum (VOC 60%). Products to be mixed/diluted before they are ready to be used must comply with the VOC limit in the final micture (ready to use).

[54] Surface coating of metal BAT: http://eippcb.jrc.es/reference/stm.html

Surface paint/-varnish in spray cans used exclusively for smaller repairs are exempted from the requirement for VOC.

Products used for surface paint/-varnish is extempted from the VOC content limit if the suface treatment proces is using a technology that collects and subsequently burn of the VOC for internal heat generation.

Organic solvents are defined as solvents with a boiling point of < 250 K at 0.013 kPa.

The requirement also includes subsuppliers.

✉ Description of surface treatment/drying and hardening process and a statement of compliance with the VOC requirement. The VOC content in products (final micture, ready to be used) is to be calculated and the data for this can be found in the safety data sheets.

Background to the requirement:
Today, traditional varnishes with a high ratio of solvents are used. Both dry varnished and water-based varnishes are available. The primary reason is the high function requirements made of the varnish, which must be able to withstand strong temperature fluctuations. The product must, for example, be air-drying, repair-friendly and temperature-resistant, be able to expand and contract, and show long-term stability. For the same reasons, there are limited alternatives to traditional varnishes.

Several organic solvents have effects that are hazardous to health. Organic solvents can be absorbed via the lungs and skin, and damage a number of organs. This damage may be acute or chronic.

Acute injury after inhaling vapours is apparent as headache, tiredness, etc. Organic solvents may also irritate the mucous membranes in the eyes, nose and throat. Organic solvents remove grease from the skin and may cause eczema. After prolonged exposure, organic solvents may lead to chronic damage to the brain and nervous system. Certain organic solvents may lead to other irreparable damage to health such as cancer and reproductive damage (foetal damage). Furthermore, some organic solvents contribute to the greenhouse effect, others to photochemical ozone formation, and others to the depletion of the ozone layer[55].

Volatile organic compounds that include one or several benzene rings are called volatile aromatic hydrocarbons (VAH). These are very stable. "Aromatic compounds" include benzene, toluene, mixed xylenes, orthoxylene and paraxylene.

According to the VOC directive, volatile organic compounds are defined as compounds that at 293.15°K have a steam pressure of at least 0.01 kPa, or equivalent volatility in special applications. For paints and varnishes, the EU has a special directive (2004/42/EC) to limit the use of VOCs, using another definition of VOCs than in the VOC directive as described above. With regard to paint, VOCs are defined as volatile organic compounds with an initial boiling point that is lower than or equivalent to 250°C, measured at a nominal pressure of 101.3 kPa.

From the BAT report "The BAT (Best Available Techniques) Reference Document (BREF) entitled 'Surface Treatment Using Organic Solvents (STS)[56]. Concerning surface treatment of other metal surfaces, BAT refers to (in English):

[55] Miljoevejledninger.dk - http://www.miljoevejledninger.dk/index.aspx?articleid=+808+808
[56] The BAT (Best Available Techniques) Reference Document (BREF) entitled 'Surface Treatment Using Organic Solvents", August 2007. ftp://ftp.jrc.es/pub/eippcb/doc/stm_bref_0806.pdf

1. reduce solvent consumptions and emissions, maximise efficiency of the coating application and minimise energy usage by one or a combination of paint, drier and waste gas treatment techniques. The associated emission values are 0.1 to 0.33 kg VOC/kg solids input. However, this does not apply to installations where the emissions are included in the mass emission calculations for the serial coatings of vehicles

2. reduce material consumptions by using high efficiency application techniques

3. use other paint systems to replace paints based on halogenated solvents.

The use of products with a high VOC content is mainly governed by two executive orders: VOC Executive Order no. 350 of 29 May 2002, based on EU directive 13/1999 and the VOC product Executive Order no. 1049 of 27 October 2005, which is based on EU directive 2004/42/EC. VOC Executive Order no. 350 governs emissions from 20 different production types if the annual consumption of VOC exceeds the stated threshold values. The directive is a minimum directive, which entails that the EU member states may set more stringent requirements than the level prescribed in the directive. The VOC Executive Order prescribed (surface treatment of metal) the use of maximum 5 tonnes of solvents per annum.

This entails in particular that the major fireplace manufacturers must use different methods for the recovery/combustion of VOC, in order to comply with legislation. National working environment legislation also prescribes the use and handling of VOC-based chemicals.

Known methods/processes used for surface finishing of closed fireplaces:

- The fireplace is sprayed by hand in the room without a local fume extractor so that personnel are exposed to a health risk and the external environment is affected by emissions in the form of hydrocarbons that build up ground-level ozone (the person that undertakes finishing must use protective equipment/ mask). Today there are several fireplace manufacturers that have an "open system" without a local fume extractor, which can entail a health risk.
- The fireplace is spray painted by hand in a finishing room where emissions are collected via a local fume extractor that prevents personnel from being exposed to a health risk.
- The fireplace is spray painted by hand in a finishing room where emissions are collected via a local fume extractor for recovery and combustion (heat production). Major fireplace manufacturers use this technology.
- The fireplace is spray painted mechanically and emissions are collected via a local fume extractor for recovery and combustion (heat production). Only few manufacturers use the mechanical technique and system for purification of emissions and heat production.

Nordic Ecolabelling wishes to continue to require that surface treatment/finishing and subsequent drying of the fireplace must take place in closed systems or in closed, ventilated rooms. The background to the requirement is to ensure that personnel are not exposed to a health risk.

Criteria version 3 sets the additional requirement that the emission of volatile organic solvent (VOC) is reduced to 20% of the organic solvent volume added, or that the VOC emission may not exceed 100 mg/m^3. Alternatively, the requirement can be documented

via a written plan for the future reduction of VOC emissions if it was not possible to install a purification system at the time of the application. The requirement has not had the intended effect (reduction of VOC at the production location) as all current licence holders have documented the requirement via a written plan for the future reduction of VOC emissions. The requirement is therefore removed from the proposal for the new criteria version 4.

Nordic Ecolabelling still wishes to press for development towards the use of water-based surface varnishes instead of traditional varnishes with a high ratio of solvents. As previously written under O3, the development in the industry is towards the use of water-based technologies (tested by manufacturers), but no manufacturers have adopted the technology yet, due to quality failures with the water-based technologies. However, Nordic Ecolabelling has ensured that the requirements do not constitute barriers to the use of water-based technologies, including via exemptions in O3.

A new requirement was proposed in the consultation saying that the surface finishing of the final fireplace must be completely hardened before it leaves the factory and ends up with the consumer.

The background to the proposed requirements for surface and finished curing is, as for the current criteria 3, to get the manufacturers of stoves/boilers to replace paints/ varnishes with high VOC content for products with a lower VOC content, or in the long term, use products that are water based. Overall, a requirement to fully cured stoves will result in a change in many production sites, and a use of extra energy/heat to complete the curing products. A large increase in energy consumption is disproportionate to the environmental benefit it will be to eliminate the last 5-10% VOC in the curing process. Therefore, the proposed requirements to surface and finished curing have been removed from the criteria document after the consultation period.

A new requirement is introduced in criteria version 4 saying that products used for surface paint/-varnish must contain a maximum (VOC 60%). The consequence of the new requirements is that it excludes the use of products for surface coating/finishing with a very high VOC content. Nordic Ecolabelling has knowledge of paints/varnish, which have a VOC content of 70-75% organic solvent. There are a number of similar products in the market, where the VOC content is somewhat lower.

The requirement will not result in major changes or investments in production by having to switch to products with lower VOC content and consequent higher dry matter content. Products to be mixed/diluted before they are ready for use, must comply with the VOC limit in the final mixture (ready to use). The VOC content in products ready to be used is to be calculated and the data for this can be found in the safety data sheets. Products used for surface paint/-varnish is extempted from the VOC content limit if the suface treatment proces is using a technology that collects and subsequently burn of the VOC for internal heat generation. This is because the technology does not have VOC emissions to the environment.

Surface paint/-varnish in spray cans used exclusively for smaller repairs are exempted from the requirement for VOC. The requirement focuses on limiting the use of surface paint/-varnish with high VOC content in the actual production of stoves. This is where the large amounts of surface-coating/-lacquer is applied. Production-wise, you may accidentally make a scratch during final assembly/packing, and this is where spray cans with surface paint are used. That is, in very small quantities. Alternatively, the stove has

to go through blasting and surface treatment process again, which is not appropriate (higher emissions of VOC).

O7 Product and transport packaging

It must be possible to recycle or reuse materials in product and transport packaging. The manufacturer must submit a description of the packaging, as well as instructions for how the packaging is to be handled in the Nordic countries in which the Nordic Ecolabelled fireplace is sold.

Chlorine-based plastic and biocide-treated/impregnated wood may not be used in the product and transport packaging.

✉ A description of the product and transport packaging and instructions for handling in the individual Nordic countries can be found in the installation manual, see O18.

Background to the requirement:
The requirement was also included in the previous version of the criteria. It must be possible to recycle or reuse materials in product and transport packaging. The material may not contain halogenated plastics such as chlorine-based plastic or biocide-treated/ impregnated wood.

This is in accordance with the Nordic Ecolabelling principle to limit these types of materials in packaging as they constitute an environmental impact. This requirement is repeated in many of the Nordic Ecolabelled product groups. Fireplaces are often transported on wooden pallets enclosed by a wooden skeleton to protect the fireplace. To further protect/stabilise the fireplace, cardboard and polystyrene, as well as plastic, are used to give protection from the wind and weather.

O8 Waste

The producer must sort at source the various waste fractions occurring in the production of fireplaces, such as waste wood, waste glass, waste electronics, plastic and metal. A waste plan with a description of waste fractions and of how the waste is handled (such as reuse, depositing and incineration) must be submitted.

✉ A waste plan with a description of waste fractions and waste recipients for the company (who collects the individual waste fractions) from the manufacturer of the fireplace.

Background to the requirement:
Waste minimisation and correct waste handling are important environmental parameters that can be undertaken by the manufacturer or a sub supplier.

To ensure quality management, waste handling requirements may be directed at the final producer.

The manufacturer must perform sorting at source of the various waste fractions occurring in production. To facilitate waste sorting, the fireplace manufacturer must draw up a waste plan with a description of the individual waste fractions and waste recipients. The requirement does not apply to sub suppliers of sub-elements in this revision. The requirement applies to all manufacturers and companies that undertake final production of fireplaces. If a licence holder has production (final production) of fireplaces at several different factories, these are also subject to the requirement.

6.3 Use and quality requirements

O9 Pressure test/leak measurement

As part of its quality management system, the manufacture must pressure test/perform leak measurement of minimum 5% of all Nordic Ecolabelled stoves for leaks. The measured leak m^3/h, measured by overpressure at 25 Pa, may not exceed the leak measurement (leak before testing) performed by the test laboratory (when testing for particle and according to practicing of standard NS 3058) by more than 10% or 1m^3/hour.

The requirement does not concern heat-accumulating stoves, pellet stoves and sauna stoves.

The result of pressure measurements showing that the requirement is complied with must be archived by the licence holder during the licence term.

☒ Routine in the quality management system describing the method used for pressure testing/leak testing, and the measures to be performed if the requirement is not complied with. Directions to pressure test specified in appendix 1.

☒ The result of pressure measurements showing that the requirement is complied with must be archived by the licence holder during the licence term.

Background to the requirement:
The requirement is new. By setting requirements of the internal control and pressure testing of all final produced fireplaces for leaks, the same high quality of the individual fireplaces is ensured as for the leak test performed by the laboratory. Today, all fireplace manufacturers continuously test their fireplaces for leaks as an element of their internal quality management system. Leak testing is expected to be part of the standards pr EN16510. However, the number of stoves that the individual manufacturer internally takes out for pressure testing varies considerably. Nordic Ecolabelling has experienced manufacturers that pressure test all of their completed stoves, to manufacturers that pressure test every 20th fireplace.

The requirements of product certification of wood-burning stoves in accordance with EN 13240, DS/EN 13240 or NS 3059[57] prescribe that internal inspection is performed with such a frequency and on such a scale that the requirements in the standard are fulfilled. The testing laboratories Sintef and Technological Institute recommend a requirement for internal control and pressure test of at least 5% of the stoves (in the same stove series), ensuring the same high quality of each stove compared to the leakage test, which is performed by the testing laboratory. SINTEF NBL has in the last 10-12 years leak tested all stoves with Sintef approval. The stoves are tested for leakage in m^3/hour at pressure of 25 Pa. This is a requirement Sintef has set without this written in NS 3058 standard or other regulatory framework. Testing laboratories accredited to the NS standard (for example, the Danish Technological Institute in Denmark or SP in Sweden) also pressure test the stoves as part of the NS test. As Nordic Ecolabelling requires testing of emissions of particulate matter by the Norwegian standard, it is natural to connect the pressure test reference value to the NS test. The licensee must have a routine in its quality management system that describes the method used for pressure/leak test, and the measures to be carried out if the requirement is not complied with (immediately changing the production, so the requirement is met).

[57] http://www.dscert.dk/da-DK/Ydelser/Produktcertificering/DownloadSBC/Documents/SBC%20247%20A%20rev%202003.doc.pdf

The result of pressure measurements showing that the requirement is complied with must be archived by the licence holder during the licence term.

6.4 Stone coating

O10 Extraction of natural stone, environmental requirements

The extraction of natural stone may not:

- disturb the deeper-lying, enclosed groundwater reservoirs.
- disturb the surface water with public water collection or sources, or water areas listed in the register created under directive 2000/60/EC of the European Parliament and of the Council (or equivalent national legislation outside the EU) of conserved areas of water courses with an average flow rate of > 5 m^3/s.
- There must be a closed system for the recovery of waste water to avoid the spreading of sawdust to the environment and to supply the recirculation cycle. The water is stored close to the place where it is used in the quarry and where it is then led (via closed pipes) to a suitable treatment plant. After clarification the water must be recirculated.

Natural stone is defined in CEN/TC 246 as pieces of naturally occurring stone and includes marble, granite and other natural stone (such as sandstone and soapstone).

Wastewater solely includes water used in production, and not freshwater from rain and groundwater.

✉ Declaration from the manufacturer/supplier of natural stone that the requirement is fulfilled. Name and location of the quarry must be specified. Appendix 4 may be used.

O11 Extraction of natural stone, working conditions

The following UN and ILO Conventions must be complied with by the producer (quarry) of natural stone:

- The UN Convention on the Rights of the Child, article 32
- The UN Convention (61/295) on the Rights of Indigenous Peoples
- ILO Convention no. 29 on forced labour
- ILO Convention no. 87 Freedom of Association and Protection of the Right to Organise
- ILO Convention no. 98 concerning the Application of the Principles of the Right to Organise and to Bargain Collectively
- ILO Convention no. 100 on Equal Remuneration
- ILO Convention no. 105 on Abolition of Forced Labour
- ILO Convention no. 111 concerning Discrimination in Respect of Employment and Occupation
- ILO Convention no. 138 concerning Minimum Age for Admission to Employment
- ILO Convention no. 148 concerning the Working Environment (Air Pollution, Noise and Vibration)
- ILO Convention no. 155 concerning Occupational Safety and Health and the Working Environment
- ILO Convention no. 170 concerning Safety in the use of Chemicals at Work
- ILO Convention no. 182 on the Worst Forms of Child Labour

If the natural stone is quarried in a country in which these conventions are part of the requirements made by the authorities, no further documentation is required, as this is subject to O30.

☒ Declaration from the manufacturer/supplier of natural stone that the requirement is fulfilled. Appendix 4 may be used.

Background to the requirement:
The requirement of stone covering is new. Nordic Ecolabelling wishes the extraction of natural stone to take place on an environmentally and socially sustainable basis. The quarrying of natural stone presents a number of environmental and social problems[58]:

Environmental problems:

- Natural stone is not a renewable resource
- Destruction of habitats and land degradation
- Pollution of groundwater and surface water
- Dust emissions and noise pollution
- Energy consumption
- Water consumption
- Waste handling
- Regeneration and rehabilitation of abandoned quarries

Social problems:

- Use of child labour
- Working conditions
- Working environment (health and safety)
- Forced labour
- Discrimination, pay, gender, ethnic origin
- Impact on the social structure (migrant labour)
- Illegal mining

Nordic Ecolabelling has no previous experience in its criteria from setting requirements for the extraction of natural stone. This is the case for the EU Ecolabel, on the other hand, in its criteria for "Hard coverings[59], which include both extraction and processing of both natural stone and processed stone. In this version, Nordic Ecolabelling solely makes requirements of natural stone, while the subsequent processing (cutting, grinding, polishing, etc.) is not subject to the requirement. Processed stone (fired stone/tiles/slabs, etc.) are not subject to the requirement either.

Natural stone is used primarily for coating and heat accumulation in fireplaces. The types of stone most commonly used are soapstone and various types of sandstone. According to fireplace manufacturers, soapstone is used mostly in Finland and Brazil, where the finished stone is also processed.

In this criteria version, requirement O10 concerns environmental requirements to protect the groundwater and surface water from pollution. The requirement is identical to the requirement made in the EU's criteria for "Hard coverings". To ensure that the

[58] SOMO, Francis Weyzig: From quarry to graveyard, Crem and India Committee of the Netherlands, September 2006
[59] http://ec.europa.eu/environment/ecolabel/products-groups-and-criteria.html

requirement also applies outside the EU, there is added "or similar national legislation outside the EU." This is to ensure, that there is no interference with the protected waters.

Nordic Ecolabelling has good experience from setting social requirements for working conditions in the form of compliance with a number of UN and ILO Conventions. This applies, for example, to the Nordic Ecolabelling criteria for textiles and biofuel for transport. The requirement must be documented via a declaration from the manufacturer (quarry) of the supplier of the natural stone. The selection of UN and ILO Conventions required under O11 adheres to the Nordic Ecolabelling criteria for biofuel.

TFT[60] is a global non-profit organisation that helps companies and society to deliver responsible products, including the extraction of stone.

In 2012, TFT developed a programme for sustainable stone production (Responsible Stone Program (RSP)) whereby its members are committed to complying with a number of ethical, social and environmental requirements, as a "Code of Conduct" for the extraction and processing of stone. The RSP programme has (1/11-2013) 18 members with representatives for quarries, producers, importers and retail chains. Nordic Ecolabelling monitors the development in TFT with regard to the next revision of the criteria and closed fireplaces.

6.5 Supplementary heating system components

O12 Solar collector

If the heating system includes a solar collector, this must be type approved according to EN 12975.

✉ Declaration from the manufacturer of solar collectors, see Appendix 5.

Background to the requirement:
The requirement was also included in the previous version of the criteria. A solar collector delivered with a fireplace must be type-approved in accordance with the EN 12975 standard.

A wood-burning stove with water tank combined with solar heating may be an alternative to the traditional heating system. The solar collector plant consists of a panel of solar cells and a combi water tank with a coil for the solar collector below and a coil for the wood-burning stove above. An electrical heating rod for emergency supply is also installed.

During the summer period, the solar collector alone heats domestic water. In the spring and autumn, this is supplemented with the wood-burning stove which gives a rapid supply of convection heating to the room and supplements the solar collector by heating the water in the top part of the combi tank. In the winter period, the wood-burning stove with the water tank handles most of the heat supply.

O13 Fuel pellet hopper

The manufacturer of the Nordic Ecolabelled pellet stove must inform the customer of how a storage facility for the wood pellets should be designed:

- to ensure that the recommended fuel retains its quality when the fuel pellets are emptied into the customer's storage hopper.

[60] http://www.tft-forests.org/product-groups/pages/?p=6281

- so that carbon monoxide that may occur when wood pellets are stored does not entail a health risk or mortal danger.

✉ Information must be provided in the instruction manual.

Background to the requirement:
The requirement was also included in the previous version of the criteria. The manufacturer of the pellet stove must inform the customer of how a hopper for the wood pellets should be designed for the recommended fuel.

7 Operation of the Nordic Ecolabelled fireplace

7.1 Emissions from closed fireplaces

The chapter below describes various problems concerning emissions to air. PAH designates PolyAromatic Hydrocarbons, which is a blanket term for several chemical substances consisting of carbon and hydrogen (also called tar substances). CO refers to carbon monoxide, OGC refers to the total content of organic gaseous carbon, and NOx refers to NO and NO_2.

Complete, efficient combustion is necessary to utilise wood as environment-friendly fuel. Besides high energy utilisation, the combustion process must therefore ensure destruction of the wood and avoid the formation of environmentally adverse compounds. On complete combustion, carbon monoxide (CO_2) and water (H_2O) are formed.

Efficient combustion requires a sufficiently high temperature, oxygen surplus, length of time, and mixture (mixture of fuel and oxygen). Factors affecting combustion emissions are primarily; air intake, the temperature in the combustion chamber and the temperature in the flue gases emitted. In non-optimum conditions, combustion will be incomplete and there will be a build-up of CO, particles, volatile organic compounds, dioxins, black carbon (BC) and PAH.

Overall, the smoke from wood-burning stoves consists of gases and particles.

Gases:

- Carbon dioxide, CO_2
- Carbon monoxide, CO
- Non-combusted gases – CH_4, tar, PAH, etc.
- Evaporated inorganic salts

Particles:

- Soot (black carbon)
- Condensed tars
- Ash
- Condensed salts

The non-combusted gases (CH_4, tars, PAH, etc.), soot and condensed tars are the main reason for air pollution.

Most of the particles from wood-burning stoves are fine particles, i.e. they are included in PM2.5[61]. It is normally assumed that 90% of the wood-burning stove's emissions are as PM2.5, while the remaining 10% are coarser particles. Typical particle diameters in PM2.5 from the smoke from wood-burning stoves are in the range of 0.2-0.5 µm. This applies to the particles' mass. When the particles are measured as a number, as for all other primary combustion particles, the largest number in the ultrafine range below 0.1 µm is found.

When combustion is optimum, the wood smoke particles, in terms of number, will be small, with a typical size of around 0.020 µm. When combustion is poorer, there will be significantly more, and larger, particles (around 0.100 µm).

Table 20. Flue gas particles on optimum, normal and poor combustion (night combustion), Thomas Nussbaumer, Verenum, Switzerland

mg/m³ at 13% O_2	Wood-burning stove, optimum combustion = 2 pieces 0.7 kg dry wood per hour	Wood-burning stove, ordinary combustion = 3 pieces 1.5 kg wood per hour	Wood-burning stove, night combustion = filled up with wood and air intake closed
Soot	< 20	< 100	5.000
Tar/VOC	< 5	400	10.000
Salts	< 20	< 20	< 20
Total	< 50	500	15.000
Factor	1	10	300

Such values are, for example, found laboratory tests by Klippel and Nussbaumer (2007). These results are completely in line with results from field measurements in detached home areas in Denmark[62,63], where the size distributions in the outdoor air were measured and where the firewood smoke's contributions were measured. In the project, flue gas samples were taken directly in the output from private wood-burning stoves or wood-burning boilers. The samples were analysed for dioxin, PAH and particle mass.

The result from the project shows strong variations in the emissions, which is due to stove type, firewood and users' combustion habits, even though the relation is unclear. There is a tendency for newer wood-burning stoves to have lower emissions of dioxin and PAH than older stoves, while the picture is less certain for particles. The field measurements did not measure sufficient new stoves to assess whether one new stove is better than another. However, the general picture is that new stoves pollute less than old stoves[64].

Generally, the results of the measurements in detached house areas show that a few individual sources contribute to the majority of the emissions. Among the stoves investigated in Gundsømagle, it could be seen, for example, that two out of 19 homes/stoves accounted for 61% of the pollution with PolyAromatic Hydrocarbons,

[61] From the Danish report entitled "Contribution of wood combustion to air pollution - Some results from project wood use, Annual Report from DCE (Danish Centre for Environment and Energy), 2010 no. 779
[62] From the report Dioxin, PAH and particles from wood-burning stoves, Working Report from DCE (Danish Centre for Environment and Energy) no. 212.
[63] From the report Particles and organic compounds in wood burning, Working Report from DCE (Danish Centre for Environment and Energy) no. 235
[64] From the report Air pollution with particles - a health problem, DCE (Danish Centre for Environment and Energy) 2009.

also called PAHs. It is thus possible to reduce the emissions considerably by targeting measures at the sources of pollution.

For the sake of completeness it must be stated, however, that even a modern wood-burning stove pollutes far more than industrial facilities per kilo of wood burned. For example, the discharge from a stove that just manages to comply with the Danish Executive Order on wood-burning stoves (10 g/kg) is several hundred times greater than from a CHP plant. Combustion of wood in private facilities is a dominating source of emissions of health-hazardous air pollution, According to a report from 2009[65], combustion of wood accounts for approximately:

- 85% of Danish tar emissions.
- 65% of Danish fine particle emissions.
- 55% of Danish dioxin emissions.

For comparison, CHP plant discharge 2-3% of Danish fine particle emissions.

There is a clear statistical relation between PM2.5 and health effects (mortality and death). DCE[66] conservatively estimate that about. 200-250 Danes die every year in average 10 years before the time because of PM2, 5 emissions from individual wood burning units in Denmark and in Europe (including Denmark) dies total approx. 650-750 prematurely due to PM2, 5 emissions from individual wood burning units on Danish soil[67].

There is a lack of knowledge, which prevents certainty concerning the risk represented by the various components of PM2.5. It is very likely that various types of particles have various hazardous health effects, but on a scientific basis there are no grounds to exempt specific components from having any health significance. Particles from wood smoke cannot be exempted in this respect. They contain, among other things, PAH (tar), which definitely has an adverse health impact.

As the basis for the discussion of emission factors, there is an important - but often neglected point that wood-burning stoves emit volatile organic compounds (VOC) that lead to the formation of particles as the smoke travels from stove to chimney edge. These gases occur in gaseous form at high temperatures, but condense at low temperature (e.g. outdoor temperature).

This can lead to misinterpretation of the measurement results. The problem is most apparent on comparison of emission factors from various countries. A report prepared for the International Energy Agency (IEA) by Nussbaumer et al. (2008)[68] presents a good description of the problems. On measuring the emission factor for particles from a wood-burning stove, a method can be used that is used in the German VDI 2066 standard, where the particles are collected at a high temperature, for example 160ºC, shortly after the combustion chamber on a filter ("SP method" – SP for solid particles).

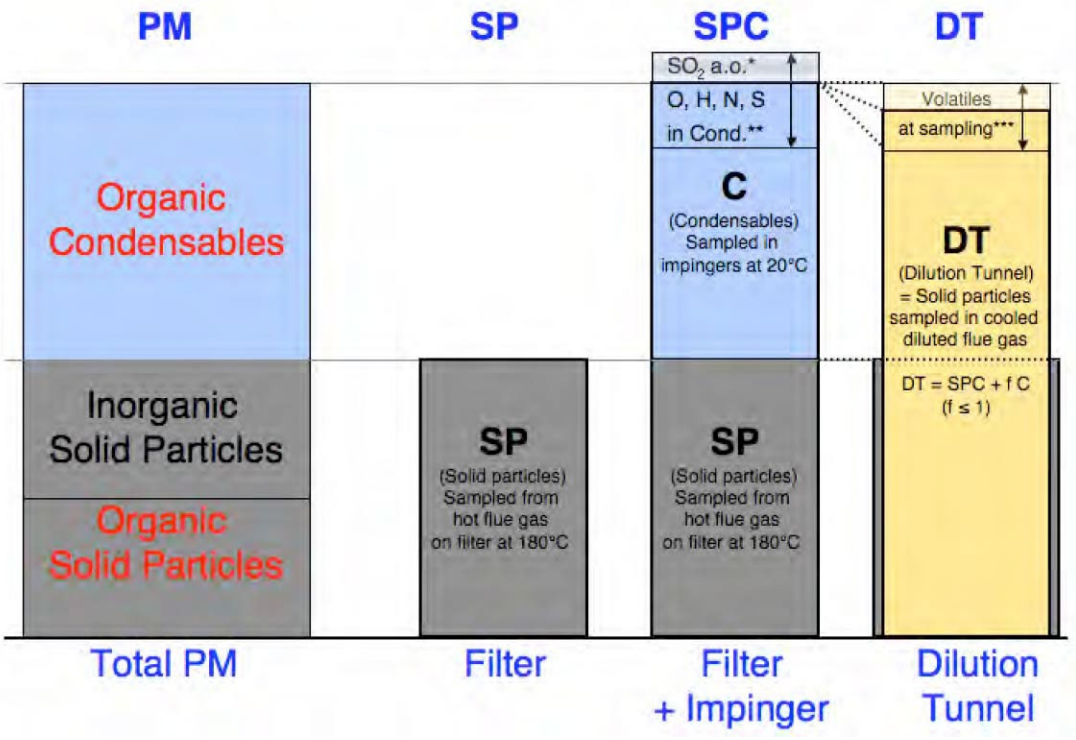
[65] NERI, Technical Report no. 744, 2009, DCE (Danish Centre for Environment and Energy)
[66] Brandt et al. 2012:Præsentation "Privat brændefyrings bidrag til helbredsskader fra luftforurening" under konferencen: Luftforurening og partikler arrangeret af IDAmiljø 27. september 2012.
[67] http://envs.au.dk/aktuelt/nyhed/artikel/privat-braendefyrings-bidrag-til-helbredsskader-fra-luftforurening-1/
[68] Particle emissions from Biomass Combustion in IEA Countries, International Energy Agency, Bioenergy Task 32, Swiss Federal office of energy (SFOE), Zürich, January 2008.

Alternatively, another method can be used, as used in the Norwegian NS 3058-2 standard, where the flue gas is led through a dilution channel before collection on a filter (the DT method for dilution tunnel). In the latter case, the gas is cooled to below 35°C, and part of it will be condensed, so that it can be found as measurable particles on the collection filter. In its criteria, the Nordic Ecolabel requires test of particles in accordance with the Norwegian NS 3058 standard with regard to wood-burning stoves, inset fireplaces and automatically-fed fireplaces (pellet stoves).

A third measurement method (SPC method for Solid Particles and condensables) includes by and large the same particles as the DT method. There are dramatic differences in measurement results between the various methods.

The figure below is from Nussbaumer et al. (2008) and states the schematic components of the firewood smoke (far left column), and which particle fractions are included under the three methods. As shown, the SP method does not include condensable material, which the other methods do. The mass of condensable material may significantly exceed the mass of solid particles. This applies especially if combustion is poor.

Figure 3. Illustrations of components in firewood smoke and the three measurement methods From Nussbaumer et al. (2008)



- **Comparison of different sampling methods with total PM in the flue gas. Explanations:**
- **PM: Total Particulate Matter in flue gas at ambient temperature.**
- **SP: Filter (Method a) resulting in solid particles SP.**
- **SPC: Filter + Impinger (Method b) resulting in solid particles and condensables SPC.**
- **DT: Dilution Tunnel (Method c) resulting in a PM measurement including SPC and most or all C. Hence DT is identical or slightly smaller than SPC + C due to potentially incomplete condensation depending on dilution ratio and sampling temperature**

(since dilution reduces not only the temperature but also the partial pressure of contaminants).

CO is an important parameter with regard to combustion, even if combustion entails a higher CO level. The measurement method for CO is inexpensive and is therefore used as a control parameter (with threshold values) in all types of combustion plant. CO itself is toxic and to be avoided.

PAH occurs when combustion is poor and some of the pollution is toxic (some are also carcinogenic). Several studies have been made that unanimously prove a relation between PAH and particles. The higher the PAH, the higher the particle ratio[69].

The Nordic Ecolabel makes a direct requirement of particles, while the risk for PAH is also assessed on the basis of CO and OGC. Other studies have previously shown that PAH are formed in similar conditions as CO and OGC.

Since analysing PAH is very expensive and time-consuming, the combination of measuring particles, CO and OGC is still a good method to assess the health and environmental risk.

NOx is a joint term for NO and NO_2, which mainly come from car exhaust, power stations and incineration plant. Pollution from petrol-fuelled vehicles has decreased as more and more vehicles are equipped with catalytic converters. The so-called SCR catalytic converters on heavy diesel lorries and buses significantly reduce NOx pollution, but on the other hand the steadily increasing number of diesel-driven passenger vehicles increase pollution. Filters and catalytic converters on diesel vehicles remove particles, but increase nitrogen dioxide pollution. Nitrogen dioxide and particles are the most health-hazardous components of air pollution. Nitrogen dioxide irritates the airways, causes respiratory problems, reduces pulmonary function and increases the risk of lung infections. NO_2 is a particular problem for people with asthmas and COPD, as well as children and young people[70].

NOx formation on combustion of firewood is mainly as "fuel NOx". I.e. as oxidation of the fuel's NOx, which to a great extent is found in the wood's bark. Wood without bark thus has a lower NOx content. Formation of thermal NOx (oxidation of nitrogen in the air) requires high temperatures (over 1200ºC), which are not achieved in a small closed fireplace[71].

The current Nordic Ecolabelling criteria (version 3) do not include requirements of the emission limits for NOx. Nordic Ecolabelling does not wish to introduce NOx requirements in this version of the criteria, due to the fireplaces' low combustion temperatures.

Climate effects - Black Carbon (BC)

Black Carbon (BC) is small soot particles formed on combustion. BC can be transported by the wind to the Arctic, for example, where the particles are deposited on the ice, turning it grey. Private wood burning and diesel motors are the dominant sources of pollution by BC in Scandinavia. In other countries, energy production, industry and field burning are also significant pollution sources. BC deposited on the inland ice increase the amount of sunlight absorbed by the ice and converted to heat. This increases the melting

[69] From the report: Air pollution with particles - a health problem, DCE (Danish Centre for Environment and Energy) 2009.
[70] http://dinhverdag.astma-allergi.dk/luftforurening/hvilkestofferforurener
[71] Presentation: Opportunities for NOx reduction, Ole Schleicher, Force Technology, 2009

of the ice. When the permafrost dries, methane and CO_2 are released, which further accelerates global warming. There is thus a risk of self-reinforcing global warming[72]. BC also contributes to health-hazardous air pollution, which leads to cardiovascular disease, respiratory conditions, etc.[73].

Emissions of BC have probably decreased in the Nordic region, compared to previously, due to tighter requirements for filters on diesel vehicles.

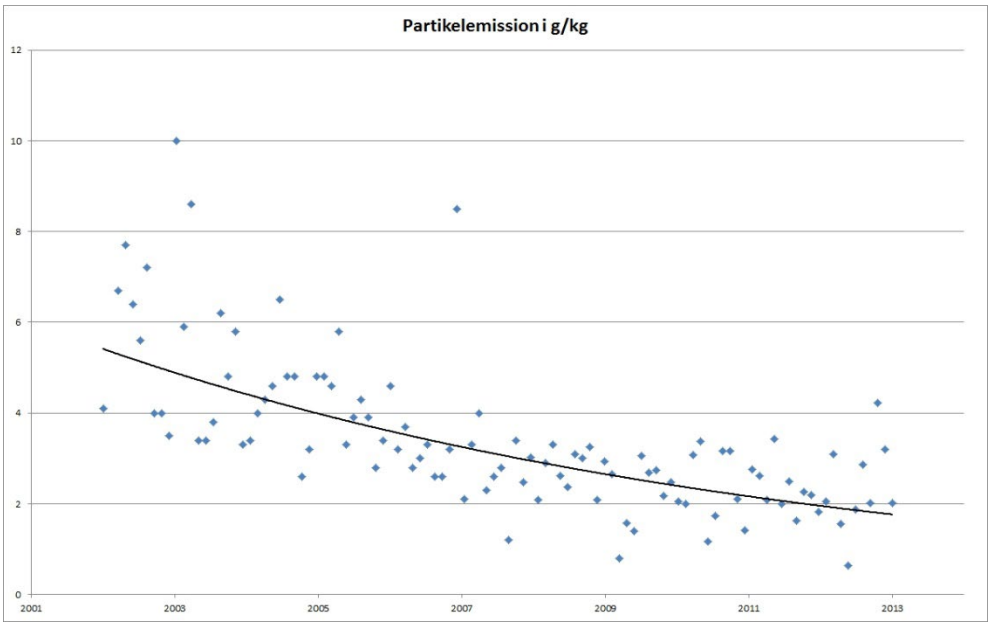
No Nordic country currently measures the surrounding BC emissions on a regular basis, among other things because the smallest particles, measured regularly, only comprise PM2.5 (BC are around the same size as PM1.0)[74]. Due to the differences in the formation of particles in general and BC, all of the measures to reduce BC will also proportionally reduce PM2.5. Measures to reduce PM2.5 will not necessarily reduce BC emissions. This means that a tight requirement for emissions of particles will not necessarily lead to a reduction of BC emissions.

Currently there is no jointly accepted standard for measurement of BC. The work of developing a standard is underway, however, on the basis of the Norwegian method (use of dilution tunnel, measurement in cold air, and at different loads). Nordic Ecolabelling follows the development of the test method, and will consider the possibility of imposing requirements for BC in the forthcoming review of the criteria.

Development in new technology in the market
Product development is generally towards more efficient, cleaner burning stoves. This development is to a high degree due to the stove's design (in combustion terms). New technologies are also being developed that all aim to achieve better combustion, higher efficiency and reduced air emissions. Several of the technologies are reviewed below. Particle emissions from testing of wood-burning stoves at the Danish Technological Institute from 2002 to 2010 thus show an average reduction of particles from approximately 6 g/kg to approximately 2 g/kg[75].

[72] Conference: Wood Burning: Nordic Solutions for Climate and Health, the European Environment Agency, 8. May 2012
[73] Janssen N, et al: Health effect of black carbon, WHO 2012
[74] International Cryosphere Climate Initiative: Legislation and Regulations in Nordic Countries to Control Emissions from Residential Wood Burning: An Examination of Past Experience, DRAFT October 2013
[75] www.teknologisk.dk

Figure 4. Development in particle emissions measured in grammes/kg for the wood-burning stoves measured by the Danish Technological Institute during the past 11 years



Automatic combustion control: More and more manufacturers offer automatic combustion control (automatic air intake control). New wood-burning stoves burn cleanly, efficiently and on an ecofriendly basis if they are operated correctly.

To achieve optimum combustion, the air to the combustion chamber must be controlled very precisely at intervals of a few minutes whenever wood is placed in the wood-burning stove. With automatic air control, the primary air intake is regulated automatically so that the user does not have to regulate combustion. According to the manufacturers, [76] this entails cleaner combustion and a reduction of firewood consumption.

Electronic control of the wood-burning stove: In large combustion plant, the combustion process is controlled and monitored on an ongoing basis to ensure optimum fuel utilisation, with the lowest possible emissions of polluting gases. Today, this is by and large not financially possible for smaller facilities because the equipment to measure the flue gas composition is very expensive. However, lambda probes are installed for oxygen control of the combustion air on a limited selection of wood-burning boilers and in 2012 Hwam launched an automatically regulated wood-burning stove in which the [77]air flow is controlled on the basis of algorithms and oxygen is measured with lambda probe originally developed for vehicles, while the flue gas' temperature is measured using a thermal element.

The Danish Environmental Protection Agency has published a report[78] based on ongoing touch-free measurement of temperature and gas composition using an IR sensor (Infrared sensor) placed on the smoke pipe from the wood-burning stove. With a time resolution of approximately 1 second, this measurement can transmit regulation signals to the wood-burning stove's user, or to an automatic air control system. In the project, an IR sensor to measure CO in flue gas from the wood-burning stove has been developed and used. Tests at the Danish Technological Institute showed that there was good

[76] www.aduro.dk
[77] http://hwam.dk/hwam+fordele/autopilot-c3-+2+versioner/autopilot+ihs
[78] The Danish Environmental Protection Agency, Regulation and monitoring of wood burning with new IR combustion sensor. Environmental project no. 1461, 2013

agreement between direct optic measurement of CO in flue pipes and their extractive gas measurement. The IR sensor can be used in existing wood-burning stoves and is used with automatic air regulation, so that the user can fire the stove correctly and achieve high energy efficiency and low emissions of air-polluting substances. The IR sensor has not yet been fully developed for commercial use.

Afterburners: Afterburners can be installed on old stoves to make them both more economical and burn cleaner. They give more complete combustion of the flue gases and thereby fewer particle emissions, according to Johan Hustad, former Professor at the Department of Energy and Process Technology at NTNU (Norwegian University of Science and Technology)[79], who also invented and patented the "Ecoxy Afterburner AS" afterburner. According to Hustad, the afterburner gives a reduction of particle emissions by 40 - 75%, depending on the type of stove. The device also gives up to 20 percentage points increased efficiency. In some municipalities, including Oslo, it is possible to apply for subsidies to install afterburners in old stoves.

Norsk Varme[80], which represents stakeholders from several of the most important stove manufacturers in Norway, does not recommend afterburners at all.

They believe that it is better to replace the stove with a new, modern stove than to install an afterburner, since a stove that burns clean will give lower emissions and better utilise the energy in the wood. The sector is supported by Morten Seljeskog of Sintef Energi. He is sceptical as to how afterburners can in practice match the new stoves with integrated combustion chambers, and is critical of the validity of the test results presented by the manufacturers. The benefits of installing an afterburner can only be achieved on firing at full output, i.e. with maximum air intake. In practice, many people close off the air intake to avoid too much heating, and in that case the afterburner will not have the same characteristics as a stove that burns clean.

Flue gas purification: In 2009-2011, the Danish Environmental Protection Agency[81] performed tests (both laboratory and field tests) of a number of flue gas purification technologies. The result of the tests was that it is possible to reduce soot emissions with electrofilters, but not VOC/tars, unless this is condensed on or to particles. There is still a need for development in this area.

Two combustion chambers - reverse combustion technology[82]: Stoves equipped with two combustion chambers function by igniting the top combustion chamber as in a traditional wood-burning stove. When the stove has the right temperature, the automatic controls shut off the chimney draw to the top combustion chamber and instead open the lower chamber. The temperature in the transition between the two combustion chambers reaches over 1,000 C, and this ignites the flammable gases that in old, poorly insulated stoves tend to pass out through the chimney without being combusted. The result is pure combustion with very low emissions as well as high efficiency compared with even new traditional wood-burning stoves.

There are some manufacturers that produce stoves based on this technology. A German manufacturer has a Nordic Ecolabel licence for a stove based on this technology

[79] http://www.tu.no/energi/2012/12/12/slik-blir-din-gamle-vedovn-renere Visited on 5 March 2013
[80] http://www.klikk.no/bolig/stue/article815462.ece Visited on 5 March 2013
[81] Danish Environmental Protection Agency: Testing of technologies for flue gas purification and/or combustion improvement for installation on existing wood-burning stoves/boiler installations, Environmental Project 1393, 2011
[82] Skøtt T: Wood burning without particles, FiB, 10th volume no. 44, June 2013

according to the previous criteria version 2. A Danish wood-burning stove manufacturer has a Nordic Ecolabel licence for a stove with reverse combustion technology according to the current criteria.

Pellet stoves: Together with SINTIF, Bionordic AS[83] has developed a new, advanced pellet stove (Jostedalen) with very low emissions. It has a rotating "pellet feed" that gives a even, uniform combustion. The pellet stove has as output of 2-6 kW and a particle emission of 0.4-1.4 g/kg and efficiency of 93-97%. Emission of CO lies at 500 mg/m^3.

Summary, new technology
In this revision, Nordic Ecolabelling has investigated the opportunity to set requirements of the automatic or electronic control of wood-burning stoves or inset fireplaces. Today, several manufacturers offer stoves with automatic control, which quite simply consist of a heat sensor metal spring or similar to control the primary air intake. Both in terms of automatic and electronic control, these technologies are governed by patents. A requirement of automatic or electronic control in this criteria version will exclude a large number of manufacturers. Nordic Ecolabelling has therefore chosen not to make requirements of these technologies in this criteria version.

Stoves with reverse combustion technology can, due to their favourable efficiency, function as the home's primary heat source. This type of stove is covered by the criteria document.

Afterburner and flue gas purification technology still require development in this area. Nordic Ecolabelling has therefore chosen not to make requirements of these technologies in this criteria version.

7.2 Emissions to air

O14 Emissions to air

The stove may not exceed the threshold values for organic gaseous carbon (OGC), carbon monoxide (CO) and particles in the following table:

Table 21. Threshold values for emissions from Nordic Swan Ecolabelled fireplaces tested with 13% O_2. The requirement applies to a normal load, if not otherwise stated

	OGC	CO	Particles
	mg/m^3	**mg/m^3**	**g/kg**
Manually operated stove or insert stove for intermittent use	100	1250	2 ($\bar{x}$ for up to 4 loads) 5 (for each load)
	mg/m^3	**mg/m^3**	**mg/m^3**
Manually operated heat-accumulating stove	100	1250	50
Manually operated sauna stove	150	1700	120
Pellet stove with automatic pellet feed	10	200	15

Test must be performed on the following terms. Test instructions are stated in Appendix 1:

[83] Bionordic AS. www.bionordic.no (visited on 2010.01.12)

Manually operated stoves or insert stoves.

Tested at nominal load for measurement of CO and OGC, and up to 4 loads within different load areas for particles according to:

- CEN/TS 15883:2009 or EN16510 for OGC
- EN 13240 or EN16510 for CO concerning stoves, and EN 13229 or EN16510 for CO concerning insert stoves
- NS 3058 and NS 3059, with loads defined in class 1 and class 2, for test of particles

Manually operated heat-accumulating stoves.

Tested at normal load according to:

- CEN/TS 15883:2009 for OGC
- EN 15250 for CO
- CEN/TS 15883:2009 for particles

Pellet stoves with automatic pellet feed.

Tested at nominal load for test of CO, OGC and particles according to:

- CEN/TS 15883:2009 for OGC
- EN 14785 for CO
- CEN/TS 15883:2009 for particles

Manually operated sauna stoves.

Tested at nominal load for CO, OGC and particles according to:

- CEN/TS 15883:2009 for OGC
- EN 15821 for CO
- CEN/TS 15883:2009 for particles

Requirements of laboratories, testing of stoves and measurement of emissions are stated in Appendix 1.

✉ Full test report.

Background to the requirement:
The requirement was also included in the previous version of the criteria, but is now proposed to be tightened.

Manually operated stoves and inset stoves for intermittent use On the basis of emission data from licence holders, in accordance with version 3 (see Appendix 1), and requirement levels in relevant official requirements and other labelling schemes, a tightening of the emission limits for CO, OGC and particles is proposed.

The requirement for CO is tightened from 1700 mg/m^3 to 1250 mg/m^3, which is at the level of the German official requirements (stufe 2[84]) applying from 31/12-2014. The requirement is tighter than for DIN+, where the CO requirement is 1500 mg/m^3 applying from 31/12-2014. The requirement of the Austrian ecolabel (Umveltzeichen 37) of CO is 1050 mg/m^3.

The requirement of OGC s tightened from 120 mg/m^3 to 100 mg/m^3. The requirement is tighter than the proposed official requirements in Denmark and DIN+, where the

[84] http://www.bmu.de/service/publikationen/downloads/details/artikel/verordnung-ueber-kleine-und-mittlere-feuerungsanlagen-1-bimschv/

requirement of OGC is 120 mg/m^3 applying from 31/12-2014. The requirement of the Austrian ecolabel of OGC is 75 mg/m^3.

The requirement of particles is tightened stepwise from <3 g/kg to <2 g/kg. The requirement is tighter than stufe 2 and DIN+, where the requirement of particles is <40 mg/Nm^3 (equivalent to <5 g/kg according to the Norwegian standard). The Austrian ecolabel's requirement of particles is <45 mg/Nm^3, which is also equivalent to around <5 g/kg according to the Norwegian standard. The official requirements in Denmark for particles are 5 g/kg and 4 g/kg from 2017.

Manually operated heat-accumulating stoves; On the basis of conversations with manufacturers of heat-accumulating stoves and requirement levels in relevant official requirements and other labelling schemes, the emission limits for OGC is tightening in version 4.

The requirement of CO is reducesed from 1200 mg/Nm^3 to 1250 mg/Nm^3, which is at the same level as for Stufe 2, where the requirement is 1250 mg/Nm^3 applying from 31/12-2014. The same level is proposed in EU ecolabel. The requirement is tighter than for DIN+, where the CO requirement is 1500 mg/m^3.

The requirement of OGC s tightened from 120 mg/m^3 to 100 mg/m^3. The requirement is tighter than for DIN+, where the OGC requirement is 120 mg/m^3.

The particle requirement is proposed to be unchange at 50 mg/Nm^3. Dialogue with especially Finnish manufacturers of heat-accumulating stoves shows that the current requirement of <50 mg/Nm^3 is tight, but that there are new models on the market that perform the requirement.

The requirement of particles is <40 mg/Nm^3 in Stufe 2 and equivalently <75 mg/Nm^3 in DIN+. Nordic Ecolabelling has no licences for heat-accumulating stoves.

Pellet stoves with automatic pellet feed: On the basis of requirement levels in relevant official requirements and other labelling schemes, a tightening of the emission limits for CO, OGC and particles is proposed in version 4.

The requirement of CO is tightened from 800 mg/Nm^3 to 200 mg/Nm^3, which is the same quality level as in DIN+. The requirement of CO in Der Blaue Engel and the Austrian ecolabel is 180 mg/Nm^3, i.e. a little tighter than the proposed quality level in the Nordic Ecolabel. The requirement of CO in Stufe2 is 250 mg/Nm^3.

The requirement of OGC is tightened from 60 mg/Nm^3 to 10 mg/Nm^3, which is the same requirement level as in Der Blaue Engel, DIN+ an the Austrian ecolabel. The requirement of particles is tightened from <3.5 g/kg to <15 mg/Mn^3 and the test method is proposed to be changed to CEN/TS 15883:2009.

The requirement of particles is tighter than the requirement level in Der Blaue Engel and DIN+ of <25 mg/Nm^3. The requirement of the Austrian ecolabel of particles is <30 mg/Nm^3. The reason for changing the measurement standard method for particles is that this measurement method is used for pellet stoves by the industry. A very large proportion of pellet stoves in the Scandinavian market are produced in southern Europe. where tests according to the European standard are not used. Nordic Ecolabelling has no licences for pellet stoves.

Manually operated sauna stoves: The requirement of emissions of CO is unchanged from the present criteria version 3. Requirement of OGC is reduced from 120 mg/Nm^3 to 150 mg/Nm^3. Requirements to particles is also reduced from 100 mg/Nm^3 to 120 mg/Nm^3. The proposed requirements in the hearing is considered to be too harsh. Sauna stoves is not used for heating up houses and the EU RES Directive does not cover Sauna stoves. There was no previous demand saying that sauna stove should be tested for emissions and efficiency before they could be sold on the Nordic market. Today Sauna stoves is required a CE marking, which requires testing of emissions of CO and efficiency. Nordic Ecolabelling is aware of that only a few models fulfil the proposed Nordic Ecolabel requirements for emissions and efficiency. Nordic Ecolabelling has no licences for sauna stoves.

7.3 Efficiency

O15 Efficiency (at nominal load)

Efficiency, (nk), at nominal load tested according to the respective standard must be at least:

- 83% for manually operated heat-accumulating stoves according to EN 15250
- 60% for manually operated sauna stoves according to EN 15821
- 76% for manually operated stoves or insert fireplaces for intermittent use according to EN13240/EN13229 or EN16510
- 87% for pellet stoves with automatic pellet feed according to EN 14785

Requirements of laboratories, testing of fireplaces and measurement of efficiency are stated in Appendix 1.

✉ Full test report.

Background to the requirement:
The requirement was also included in the previous version of the criteria.

Manually operated stoves and inset stoves for intermittent use: On the basis of data from licence holders, in accordance with version 3, and requirement levels in relevant official requirements and other labelling schemes, the efficiency requirement is tightened. Data from licence holders can be found in Appendix 1. The efficiency requirement is tightened from 75% to 76%. These requirements ensure that producers have flexibility to develop stoves with low emissions. The requirement is tighter than in Stufe 2, where the requirement is 75%. The Austrian ecolabel's efficiency requirement is 80%, which is the same requirement level as proposed in the now rejected proposed ecodesign requirement.

Manually operated stoves and inset stoves are, in practice, strongly dependent on the person that operates the stove, as well as the fuel quality. The stoves are often used as a supplementary heat source, so that in the Nordic Ecolabel requirement the emphasis is on emissions to the air, rather than a tight efficiency requirement. Design, structure and the location of chimneys at consumers also set a natural limit to the stove's efficiency. It is, quite simply, very difficult to achieve a draw of 12 Pa in chimneys for which the stove is tested in the test laboratory, and thereby ensure efficient, clean burning with low emissions and high efficiency. An efficiency requirement of 80% will entail that only 46% (35/76) Nordic Ecolabelled stoves (combustion chambers) would fulfil the requirement.

Manually operated heat-accumulating stoves: On the basis of conversations with manufacturers of heat-accumulating stoves and requirement levels in relevant official requirements and other labelling schemes, the efficiency requirement is unchanged at 83%. According to the current market information, modern heat-accumulating stoves have an efficiency that varies between 80-92%. The efficiency requirement is tighter than DIN+ and Stufe 2, where the requirement is >75%. The requirement to apply for funding according to EU RES Directive (2009/28/EG)[85] is an efficiency requirement of 85%.

Pellet stoves with automatic pellet feed: Based on data from manufacturers and requirement levels in relevant official requirements and other labelling schemes, the efficiency requirement a tightened from 85% to 87%. Review of a number of manufacturers websites shows a spread in the pellet stoves' efficiency of between 85 and 90% (very few achieve 90%). The Nordic Ecolabel's efficiency requirement of 87% is below the equivalent requirement level of 90% in Der Blaue Engel and the Austrian ecolabel. As very few pellet stoves (according to the Nordic Ecolabel's investigations) can fulfil an efficiency requirement of 90%, in this version an efficiency requirement of 87% is proposed. This is a tightening of the efficiency requirement from 85% to 87%.

Manually operated sauna stoves: The efficiency requirement is unchanged from the present criteria version 3. Sauna stoves are not used to heat homes and are, for example, not subject to the renewable energy directive or to prEN16510-1. The sauna stove's function is to achieve a high flue gas temperature (400 - 600 °C) so that the stove (stones) become sufficiently hot. The efficiency is hereby reduced. The best sauna stoves in the market can have an efficiency of 60%, which corresponds to the Nordic Ecolabel requirements.

7.4 Consequence of emission and efficiency requirements

For manually operated stoves and insert stoves for intermittent use, the Nordic Ecolabel sets tighter emission requirements for CO, OGC and particles, compared to DIN+. DIN+ makes further requirements of emissions of NOx, which are not subject to the Nordic Ecolabel requirements. The efficiency requirement (76%) is below the requirement level (78%) in DIN+. The consequence of the Nordic Ecolabel requirements for emissions and efficiency is:

A requirement for particles of 3 g/kg (from 1/7-2014 to 30/6-2017) leads to 44% (35/79) of our currently approved combustors meet the requirement. A requirement for particles of 2 g/kg (from 1/7-2017 to 30/6-2019) leads to 16% (13/79) of our currently approved combustors meet the requirement.

As previously stated, the Nordic Ecolabel has no licences for heat-accumulating stoves, pellet stoves with automatic wood pellet feed, or sauna stoves.

7.5 Noise

O16 Noise

The noise level from automatic pellet feed pellet stoves may not exceed 50 d(B)A during normal use according to ISO 3743.

[85] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:DA:PDF

Laboratory requirements are stated in Appendix 1.

✉ Full test report.

Background to the requirement:
The present requirement for the sound output from pellet stoves with automatic pellet feed may not exceed 55 d(B)A. In contrast to a traditional wood-burning stove, pellet stoves make a little noise.

For the stove to function, it usually has two fans. One fan to distribute heat from the stove into the room, and a fan on the smoke output (smoke extractor). There are several pellet stoves in the market that fulfil the Nordic Ecolabel's current noise requirements.

The Swedish energy authorities have tested ten different pellet stoves[86] for noise, among other things, where the noise levels are 40-61 dB(A) at lowest outputs and between 47-61 dB(A) at highest outputs. The Norwegian "Jostedalen" pellet stove has a noise level of 38 dB(A). The manufacturer "Thermorossi" markets several of its models with noise levels of 36 - 38 dB(A). As noise is an important parameter for a good indoor climate, Nordic Ecolabel has tightened the requirement in this version 4 from 55 d(B)A to 50 d(B)A.

7.6 Declaration from the test laboratory

O17 Declaration concerning test of emissions, efficiency and noise

A test laboratory must declare that the stove has been tested in accordance with the standards stated in O14-O16.

The test laboratory must be accredited according to the current standards stated in Appendix 1.

✉ Declaration that the requirement is fulfilled.

Background to the requirement:
The requirement was also included in the previous version of the criteria. Test laboratories do not always submit an official test report, but merely a description of their tests, which can be difficult to control. The test conditions may have been different, or other methods may have been used. In such circumstances, further tests must be performed. Below, various situations are described in which complementary documentation may be required.

Situation 1: Nordic Ecolabelling has required tests according to harmonised EU standards and Norwegian standards. When Nordic Ecolabelling began to develop criteria for closed fireplaces, each of the Nordic countries proposed various legislation in terms of test methods, test parameters and tests at various loads. One starting point could have been to require tests according to the EN method, but both Norway and Sweden's own standards were better designed to reflect the actual environmental impact.

Nordic Ecolabelling has chosen to support the use of the Norwegian testing method for particles, since it states particle volume after cooling of the flue gases, which resembles the real exposure situation to a greater degree than on testing in the actual chimney. This discussion is still very relevant with regard to the standardisation of new test methods. The various test methods for particle measurement are not directly comparable, which

[86] http://www.energimyndigheten.se/Hushall/Testerresultat/Testresultat/Pelletskaminer/

can make it difficult for case officers at Nordic Ecolabelling to draw conclusions form test reports with alternative test methods.

Situation 2: Different accredited test laboratories measure according to the same standard, and gain varying results.

Another complication has been that measurement results from accredited test laboratories in various countries do not correlate with each other.

The difference between the results from the various test laboratories can be vital to the opportunities to gain a licence.

Nordic Ecolabelling has received test reports for the same fireplace tested at laboratories in various countries (according to the same EN standard) and noted relatively large variations between the results. This can be partly explained by the variations between the individual tests and that tests were performed at different times, but there should not be large variations between the results. According to Jes S. Andersen[87] (Danish Technological Institute) there are less differences between the laboratories today than was previously the case.

Situation 3: Some test laboratories do not submit complete test reports.

Some test laboratories do not submit the complete test report. This entails, for example, that it is impossible to find out which sub-loads were used for the measurements. In connection with licensing, Nordic Ecolabelling must therefore require supplementary documentation in order to achieve a complete test report.

Situation 4: On use of alternative test methods.

In certain cases, an alternative test method for particles can be accepted, provided that the sub-loads can be read, and that the results have been good enough for the probability of a sudden dramatic increase in the particle content under a defined sub-load is minimal. Such an assessment can only be made by an accredited test laboratory. A declaration is made to confirm the accuracy of the assessment.

The test laboratories must declare that they have tested the fireplaces in accordance with the specific requirements of the test methods stated in Appendix 1. Nordic Ecolabelling is entitled to require further documentation. In the event of uncertainty during case processing as to whether requirements in O14-O16 are fulfilled, the laboratory must declare that the fireplace in question fulfils requirements in O14-O16.

8 Customer information

8.1 Installation, operating and maintenance instructions

O18 Installation manual

There must be an installation manual for each stove delivered. The installation manual must be written clearly in the national language in the Nordic country in which the fireplace is sold and installed. The manual must also be available on the manufacturer

[87] Telephone conversation with Jes S Andersen, Danish Technological Institute, 26 September 2013

and/or distributor's website(s). The manual must present recommendations and information on:

- the installation of the fireplace and any particle filter in the designated way, and a recommendation for the fireplace to be installed by an authorised/competent distributor/installation technician, as well as reference to the present;
- technical information/specifications concerning the stove;
- the required volume of air for combustion, air volume in m^3 per hour;
- distance to flammable material;
- position of the stove on refractory material (free-standing stoves);
- the space required for operation, maintenance and cleaning;
- recommendations for chimney height (in meters insulated chimney), from the stove flue.
- instructions for the type of smoke flue/chimney to which the stove/fireplace may be connected in terms of flue gas temperature, drawing, dimension, height and position of the smoke flue/chimney;
- instructions for the design of the wood pellet hopper, if this fuel type is used how the wood pellet hopper must be designed for the fuel to retain its quality on emptying and storage, and so that any carbon monoxide arising as a consequence of the storage of wood pellets does not present a health risk or mortal danger;
- ventilation and installation of sauna stoves according to the dimensions of the sauna;
- how the packaging is to be handled in the Nordic countries in which the stove is sold;

✉ A copy of the installation manual, which must be included when the stove is delivered to the installation technician and customer.

O19 Operating and maintenance instructions

Operating and maintenance instructions must be included with each stove delivered. The instructions must be written clearly in the national language in the Nordic country in which the stove is sold and installed. The instructions must also be available on the manufacturer and/or distributor's website(s). The instructions must include details of:

- information on how various fuel types (types, materials, quality, moisture content) affect output and emissions;
- instructions to the wood's moisture content should not exceed 18%, and that you can buy moisture meter to continuously monitor the proper moisture content. Firewood with a diameter of more than 10 cm and should be split;
- fuel types suitable for the stove, and that fossil fuels should not be used that Nordic Ecolabelled wood pellets should be used in pellet stoves;
- recommendations for the handling and storage of firewood, wood pellets and any other solid biofuels;
- how the stove is lit.
- instructions for filling and the volume and size of firewood on lighting/filling
- adjustment of air intake. How, by which measures, sufficient combustion air to the stove is ensured;
- that low air intake can lead to poor combustion, high emissions and poor efficiency;
- instructions for cleaning, inspection and maintenance of the stove and any particle filter;
- instructions describing the recommended maintenance;

- content of the guarantee and validity in number of years must be stated. The guarantee must fulfil the requirement in O2;

✉ A copy of the operating and maintenance instructions, which must be included when the stove is delivered to the installation technician and customer.

Background to the requirements:
The requirement (O18 and O19) is adjusted slightly from the previous criteria version. Certain requirements in the criteria are documented in the installation manual. These requirements are primarily intended to ensure that the stove is installed and used in the correct way, to minimise the environmental impact.

Even if a stove yields good test values in the test laboratory, in practice its incorrect installation and use can entail major negative environmental impacts.

Requirements of competent installation technicians. The optimum situation would be that all Nordic Ecolabelled fireplaces were installed by certified installation technicians. From a market viewpoint, it has been impossible to make such a requirement. Instead, it is now emphasised that the manufacturer must recommend that the fireplace is installed by an authorised/competent fitter or distributor. There must also be a reference to where the customer can find competent installation technicians.

This is completely in line with the renewable energy directive (2009/28/EG), which requires that installation technicians for boilers and stoves for biomass must have sufficient knowledge to:

- Meet the customer's needs for efficiency and reliability
- Present qualified professional skills
- Comply with current acts and regulations

Requirements for the recommendation of chimney height (in meters chimney), from the fireplace flue. Chimney design is very important, especially since we require more efficient combustion. Availability of air circulation is another very important factor. In well-insulated low-energy buildings it may in some cases be necessary to create a combustion air system that ensures a constant air intake to the combustion site.

In the various stoves technical data sheet, there is provided a minimum chimney draft abandoned in PA (Pascal). This corresponds to a certain number of meter chimney, which is different from model to model. Nordic Ecolabelling requires that the chimney draft must now be expressed in meter chimney, as this makes more sense for the buyer than the figures provided in PA. The manufacturer can specify the height of the chimney based on an insulated steel chimney, as such is used when testing the stove.

When the smoke is going out through the fireplace flue/channels, it is meet by a flow resistance. This resistance must be compensated by the required chimney draft. The chimney draft is generated by the difference in weight between the warm air, which is in the chimney, and a corresponding number of litres of atmospheric air. In operating instruction manuals it is often said, that you need to make sure that there will be enough air for combustion, but a stove cannot suck in more air than the chimney can pull out. It is therefore important that the chimney draft (negative pressure) at least match the resistance of the stove, to ensure a clean burning as possible.

It is also recommended to contact the chimney sweep for inspection of the existing chimney before a decision on the choice of fireplace is made. Chimney sweeps have pointed out how they are sometimes in a difficult situation when they visit a customer to inspect an installation and discover that the fireplace and chimney are not compatible.

Fuel: Correct wood burning requires that only clean, dry wood is used[88]. If the wood is too wet, the stove will be cooled down and combustion will be incomplete. The fuel's water content should not exceed 18%.

This is because wet wood pollutes more and some of the energy and heat is spent on drying the fuel in the stove. This means that the fuel yields less heat. At the same time, the stove and chimney will fill up with soot, which in the final analysis can set the chimney on fire.

Newly felled wood contains approximately 60-70% water and is not suitable for combustion. As a rule of thumb, newly felled wood must be stacked to dry for minimum 1 year. Wood with a diameter of more than 10 cm should also be cleaved.

Private individuals are not permitted to burn waste (refuse). This also applies to waste wood such as pallets, chipboard residue, old fences, garden furniture and other types of treated wood. Refuse and waste wood are not firewood, but waste - and must be submitted to the local recycling station or the municipal collection scheme.

Information to the customer on how different types of fuel (types, materials, quality, moisture content) affect output and emissions is important, to ensure good combustion.

Lighting a fire - in a new way: A new fire lighting method, the "top down" method, can eliminate up to 42% of the particle emissions from wood-burning stoves and inset fireplaces[89][90]. The method is as follows: Place two pieces of firewood in the bottom of the fireplace. Add a pile of kindling stacked in layers with air in between, so that you can light the top. The flames must move downwards from the top, like a candle. Too much firewood, or pieces that are too large, can impede the air intake. It is therefore important to use smaller pieces of firewood, to get a good blaze. By lighting the top part of the fuel you can eliminate up to 42% of the particle emissions from your wood-burning stove.

Nordic Ecolabelling recommends that the customer is informed about this new lighting method, as it is important to ensure good lighting with low emissions.

[88] http://www.mst.dk/Borger/luft/Braendeovne/saadan_fyrer_du_fornuftigt/Brug_rent_og_toert_trae.htm, visited on 7 October 2013
[89] Miljøprojekt nr. 1478: 'Miljøråd - En samfundsøkonomisk analyse', udført af NIRAS 2013
[90] http://www.mst.dk/Borger/luft/Braendeovne/saadan_fyrer_du_fornuftigt/Fyr_lidt_ad_gangen.htm, visited on 7 October 2013

9 Information to distributors and installation technicians

9.1 Competence requirements

O20 Competence requirements

In cases where the stove is equipped with a water tank (water bank) and/or solar collector, the manufacturer must inform the distributor/installation technician that:

- the stove equipped with water tank and/or solar collector must be installed by a certified installation technician.

✉ Information provided to the distributor or installation technician.

Background to the requirement:
The requirement is tightened from the previous criteria version, so that now installation must be by a certified installation technician, The European renewable energy directive (2009/28/EC), article 14, requires installation technicians for boilers and stoves (connected to a water system) and solar collectors to have sufficient knowledge to:

- Meet the customer's needs for efficiency and reliability
- Present qualified professional skills
- Comply with current acts and regulations

The directive also requires:

- Accredited training
- Personal certification with approved examination concerning both theory and practice
- Validity subject to time limitation

The requirement of competence and certification includes all boilers and stoves for biomass connected to a water system, as well as solar collectors. According to the renewable energy directive, each member states must have built up a functioning training and certification system by 31 December 2012 at the latest.

In Denmark the KSO scheme[91] is a quality assurance scheme for biofuel systems, solar heating plant and solar cell systems. The KSO scheme is directed at companies that work with installation and service of biofuel, solar heating and solar cell systems. The purpose of the scheme is to ensure that installed systems fulfil the quality requirements and that the companies in the scheme can document this. A company can achieve membership of the KSO scheme if the company has one or more employees with a KSO installer certificate. The installer certificate is issued by the KSO scheme to persons who complete a KSO course and pass the subsequent test.

In Sweden, the Sweden Energy Agency, together with the Swedish National Board of Housing, Building and Planning, has created a voluntary training and certification system for installation technicians in Sweden, in accordance with the renewable energy directive[92]. The Swedish National Board of Housing, Building and Planning owns the

[91] http://www.kso-ordning.dk/
[92] http://www.energimyndigheten.se/sv/Foretag/Energieffektivt-byggande/Certifiering-av-installatorer-av-fornybar-energi-/

specifications of requirements according to which the installation technicians can achieve certification.

9.2 Dimensioning and design of the heating system

O21 Dimensioning and design of the heating system

In cases where the stove is equipped with a water tank and/or solar collector, the manufacturer of the stove must ensure that the installation technician has easy access to relevant information and technical data to be able to undertake the dimensioning of the heating system.

✉ Declaration from the manufacturer of the fireplace that the requirement is fulfilled.

Background to the requirement:
The requirement was also included in the previous version of the criteria. As for other types of fireplace, the heating system must be dimensioned correctly in relation to the building's heating requirement. If the heating system is too large, the room(s) will be too hot. If the problem is solved by turning down the combustion air to the fireplace, instead there is poorer combustion, with the risk of environmental hazards in the form of high emissions of particles, tar components and carbon monoxide, for example. Heath and environmental hazards can therefore be reduced by dimensioning the heating system according to the customer's home.

9.3 Other information

O22 Other information

The manufacturer must inform the distributor that:

- The stove must be installed by a competent installation technician and approved by the chimney sweep before you use it.
- Recommendations for chimney height (in meters insulated chimney), from the stove flue. The importance of the chimney is designed for each stove requirements for draft. Moreover, recommendation to the height of the chimney must be a minimum of 1 meter higher than the ridge/housing highest point.
- Instructions for proper combustion/operation of the stove/fireplace.
- The customer/user must have access to the installation manual and the operating and maintenance instructions.

✉ Information provided to the distributor.

Background to the requirement:
The requirement has been adjusted in criteria version 4 to clarify the importance of the chimney must meet the stoves needs and concern for the environment.

9.4 Quality and regulatory requirements

To ensure that the product meets the criteria for the Nordic Ecolabel throughout the time that the licence remains valid, Nordic Ecolabelling sets requirements concerning quality procedures for licensees and any subcontractors.

If the manufacturer has a certified environmental management system acc. ISO 14 001 or EMAS, the following procedures are implemented, it is sufficient for the accredited auditor to certify that the requirements are implemented.

O23 Licence administrators

The company shall appoint an individual responsible for ensuring the fulfilment of Nordic Ecolabel requirements, and a contact person for communications with Nordic Ecolabelling.

✉ Organisational chart showing the responsible contacts.

O24 Documentation

The licensee must be able to present a copy of the application and factual and calculation data supporting the documents submitted with the application (including test reports, documents from suppliers and suchlike).

🔑 One- site inspection.

O25 Quality of the stove

The license holder must ensure that the quality of the Nordic Ecolabelled stove/fireplace not deteriorate during the term of the license.

✉ Procedures for collating and, where necessary, dealing with claims / complaints regarding the quality of the Nordic Ecolabelled stoves.

O26 Planned changes

Planned product and market changes affecting Nordic Ecolabel requirements must be in writing to Nordic Ecolabelling.

✉ Procedures detailing how product and marketing changes are handled.

O27 Unforeseen nonconformities

Unforeseen nonconformities affecting Nordic Ecolabel requirements must be reported to Nordic Ecolabelling and journalled.

✉ Procedures detailing how unforeseen nonconformities are handled.

O28 Traceability

The licensee must have a traceability system for the production of the Nordic Ecolabelled stoves/fireplaces.

✉ Description of/procedures for the fulfilment of the requirement.

O29 Take-back system - removed

The Nordic Ecolabelling's Criteria Group decided on the 9 October 2017 to remove this requirement

O30 Legislation and regulations

The licensee must guarantee adherence to safety regulations, working environment legislation, environmental legislation and conditions/concessions specific to the operations at all sites offering the Nordic Ecolabelled service.

No documentation is required but Nordic Ecolabelling may revoke the licence if this requirement is not fulfilled.

O31 Marketing - removed

The requirement is removed as decided by the Board of Directors 17 November 2014.

The requirements O23 to O30 is the general quality assurance requirements to ensure that the Nordic Ecolabelled products meet the requirements and that laws and regulations are met so that the products comply with the environmental quality as was the intention of the criteria. Most of these requirements are general and apply to all production of Nordic Ecolabelled products.

10 Changes from the previous version

Table 22. Overview of changes in the requirements on the revision of version 3 to version 4

Revised criteria (4.0)	Previous criteria (3.0)	Comment
General		The product group definition has changed a bit compared to the criteria version 3. Manually operated stoves for continuous use has now been removed from the criteria.
O1	K1	The requirement of the description of the production process is not changed in this version.
O2	K2	The materials requirement is updated according to standards. It is emphasised in the documentation requirement that materials descriptions/material elements and technical drawings approved by the test laboratory must be submitted.
O3	K3	The requirement is updated according to CLP and tightened with a prohibition of chemicals classified as R53/R52 (ac 3 with H412), R53 (ac 4 with H413), R33 (H362), R64 (H362). Varnishes for surface treatment classified as R52/53 (H412) are exempt from the requirement.
O4	K4	The requirement of ingoing substances is tightened slightly to now also include nanoparticles.
O5	K6	The requirement of metal coating of parts is not changed in this version.
O6	New requirement	Products used for surface paint/-varnish must contain a maximum (VOC 60%).
O7	K7	The requirement of product and transport packaging is not changed in this version.
O8	K8	The waste requirement is not changed in this version.
O9	New requirement	The manufacturer must pressure test min. 5% of all finally produced manually operated stoves or inserts stoves for leaks (quality requirement).
O10	New requirement	Environmental requirement for the extraction of natural stone in quarries.
O11	New requirement	Requirement of working conditions on the extraction of natural stone in quarries.
O12	K9	The requirement of solar collectors is not changed in this version.
O13	K10	The requirement of wood pellet hoppers is not changed in this version.
O14	K11	Requirements for emissions of CO, OGC and particles is tightened. For pellet stoves, the requirement for particle test is changed from the Norwegian NS3058 method to CEN / TC 15883: 2009.
O15	K12	Efficiency requirement for manually operated stove or insert stove for intermittent use and pellet stoves is tightened. Efficiency requirement for other product groups are not changed in this version.
O16	K13	The noise requirement for pellet stoves with automatic wood pellet feed is tightened from 55 d(B)A to 50 d(B)A.
O17	K14	The requirement of a declaration from a test laboratory is not changed in this version.
O18	K15	The installation manual requirement is adjusted slightly in the information requirement for installation technicians and the smoke flue/chimney.
O19	K16	The requirement of operating and maintenance instructions is adjusted slightly. New requirement for information on "top down" lighting and specification of fuel requirement/moister content and insulating plates.
O20	K17	The manufacturer must now inform the distributor that the fireplace's water tank and/or solar collector must be installed by a certified installation technician.
O21	K18	The requirement to dimensioning of the heating system is not changed in this version.

O22	K19	The requirement is adjusted slightly regarding information requirements for approval of the installation, chimney height and instructions for proper combustion.
O23-30	K20-28	Updated to the Nordic Ecolabel's latest wording of these general quality and environmental management requirements.

11 New criteria

In any forthcoming new criteria version it will be relevant to include the following items in the evaluation:

- Materials and chemicals requirements
- Surface finishing - requirement to use water-based surface finishing
- RPS concerning whether the fireplace is easy to dismantle for recycling
- Levels of emissions and efficiency required It must be investigated whether requirements are to be made of emissions of Black carbon (BC)
- New technologies to improve combustion in the closed fireplace
- Relation to EU ecodesign and energy labelling
- Impact of particle size on health

Terms and definitions

Term	Explanation or definition
BC	Black Carbon
CO	Carbon monoxide
OGC	Organically bound carbon/volatile hydrocarbons
PAH	Polycyclic aromatic hydrocarbons
NOx	Nitrogen oxides
VOC	Volatile organic compounds
RPS	Relevance, Potential and Controllability: Tool to analyse whether environmental problems are relevant, whether there is potential for improvement, and whether a licence holder has the control measures in place to achieve these environmental improvements.
PVC	Poly vinyl chloride
CMR substances	CMR substances are carcinogenic, mutagenic and reprotoxic substances
PM2,5	Threshold value for fine particles (PM2.5)

Appendix 1 Measurement results from Nordic Ecolabelled wood-burning stoves and inset fireplaces

Table 23. Measurement results from Nordic Ecolabelled wood-burning stoves and inset fireplaces The Nordic Ecolabel's current threshold value: 1700 mg/m³ (green line). Proposed new threshold: 1250 mg/m³ (red line)

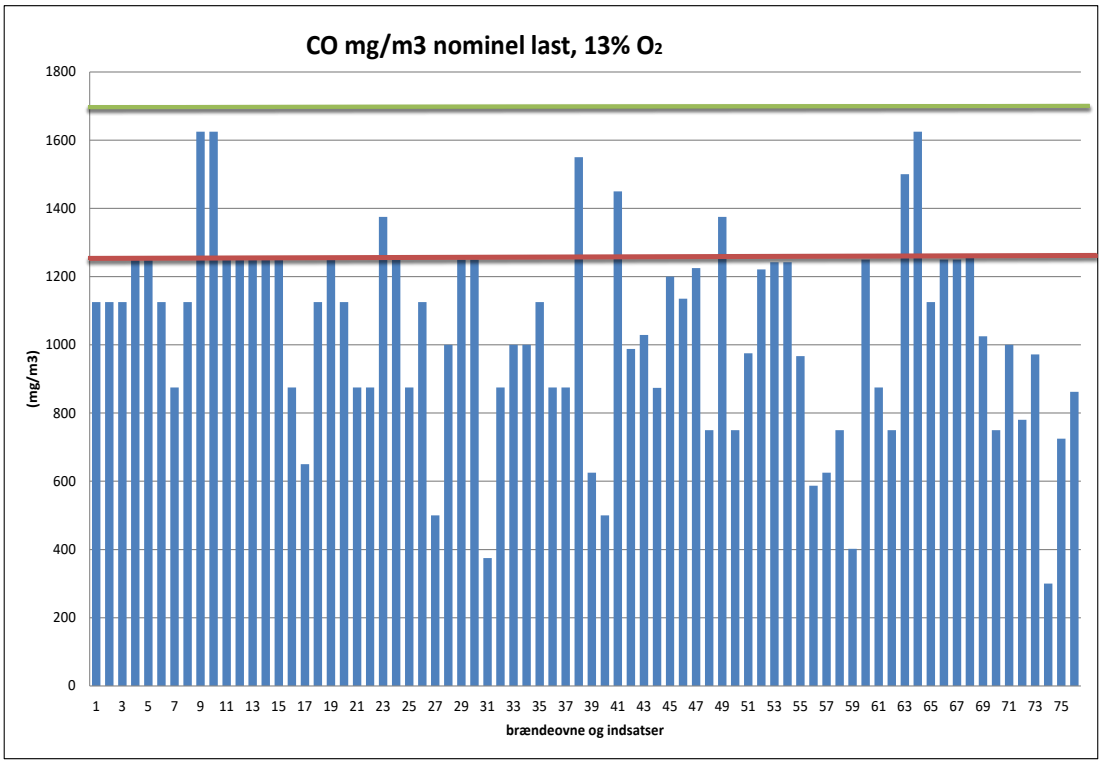


Table 24. Measurement results from Nordic Ecolabelled wood-burning stoves and inset fireplaces The Nordic Ecolabel's current threshold value: 120 mg/m³ (green line). Proposed new threshold: 100 mg/m³ (red line)

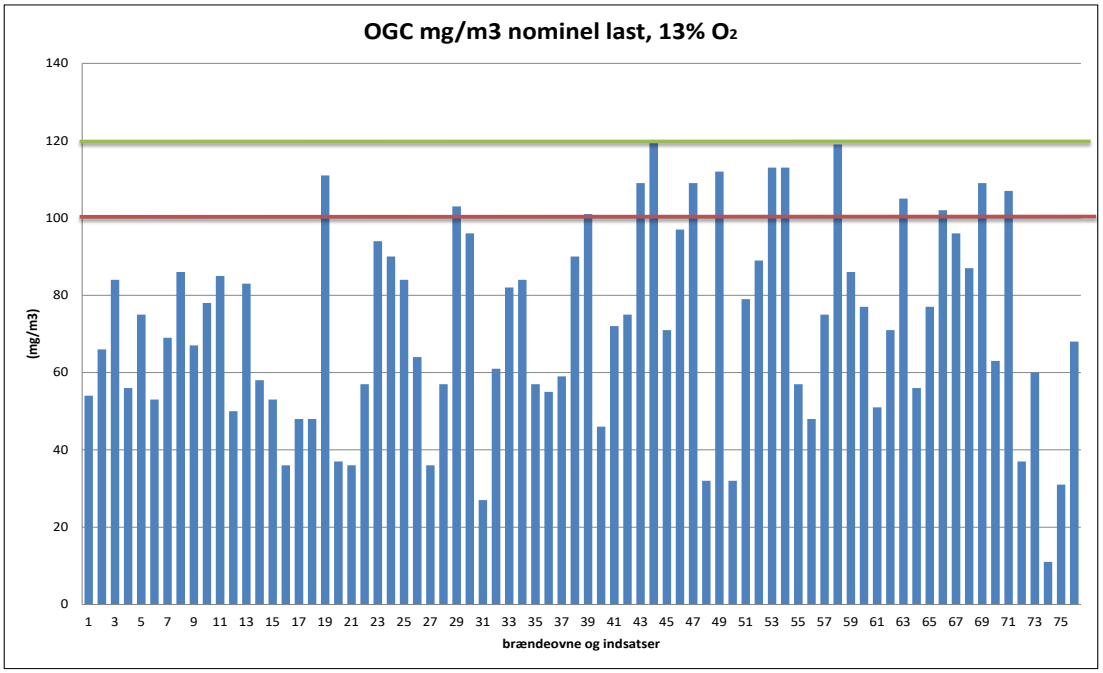


Table 25. Measurement results from Nordic Ecolabelled wood-burning stoves and inset fireplaces The Nordic Ecolabel's current threshold value: 4.0 g/kg (green line). Proposed new threshold: 2.0 g/kg (red line)

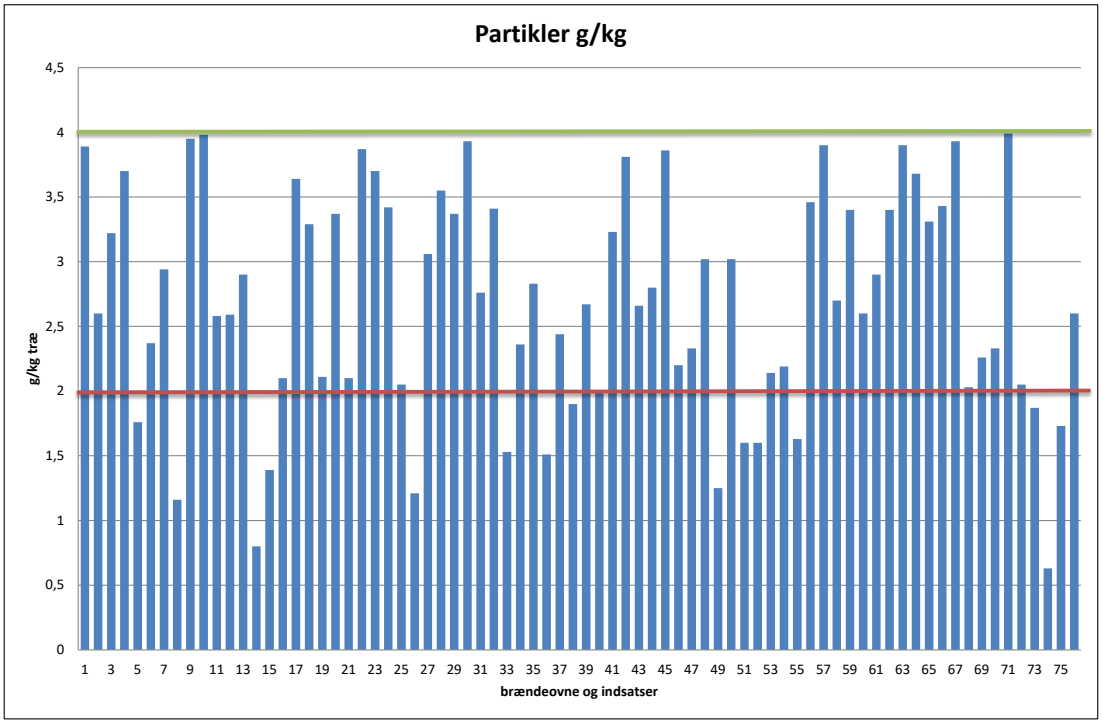
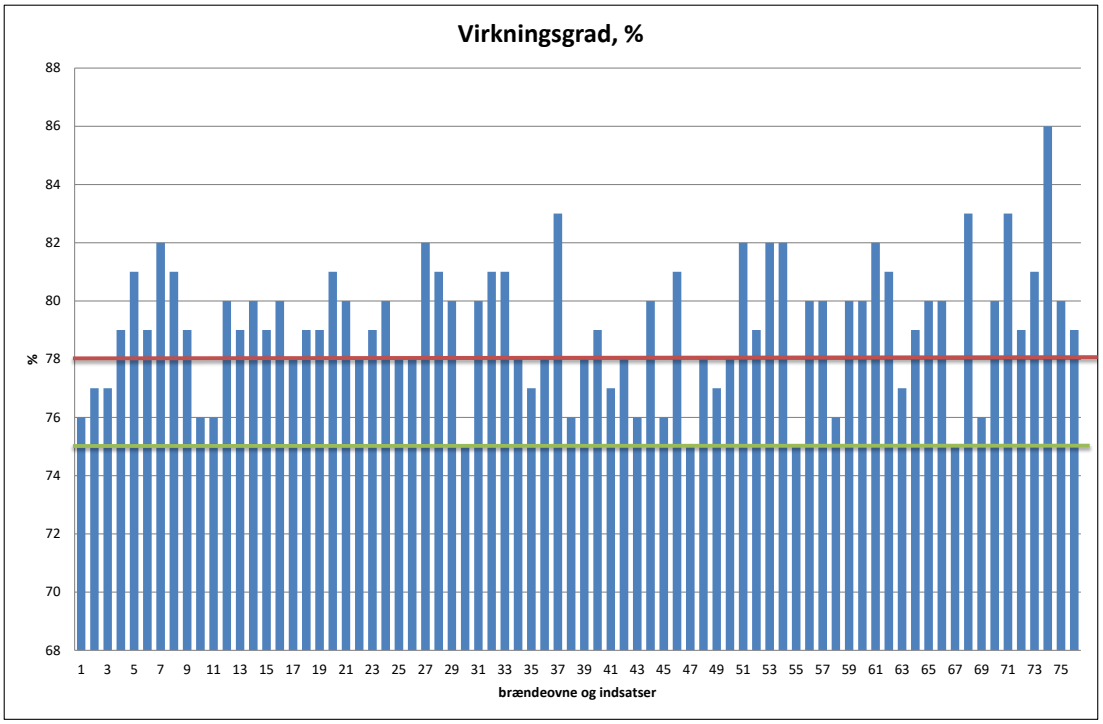


Table 26. Measurement results from Nordic Ecolabelled wood-burning stoves and inset fireplaces The Nordic Ecolabel's current threshold value: 75% (green line). Proposed new threshold: 78% (red line). New final threshold: 76%



Appendix 2 Overview of the authorities' requirements and other labelling schemes

Table 27. Official requirements and requirements in other labelling schemes for wood-burning stoves and inset fireplaces

	Standard measurement method	**Efficiency**	**CO**	**Particles***	**OGC**	**NOx**
		nominal	**nominal**	**nominal low load**	**nominal**	**nominal**
CE Class 1	EN13240	> 70%	< 0.3%	-	-	-
CE Class 2	EN13240	> 60%	< 1.0%	-	-	-
CE Class 3	EN13240	> 50%	< 1.0%	-	-	-
DS	DS/EN13240	> 70%	< 0.3%	-	-	-
DS+	DS/EN13240	> 70%	< 0.3%	< 20 g/kg	-	-
Order No. 1432	NS3058 DIN/EN 13240			< 10 g/kg 75 mg/Nm^3		
Rev.proposal Order No. 1432, valid from 1/7-2016	NS3058 DIN/EN 13240	-	-	< 4 g/kg 30 mg/Nm^3	< 120 mg/Nm^3 80 mg/Nm^3	-
NS	NS3058	-	-	< 5 g/kg (catalytic converter) < 10 g/kg (other technology)	-	-
EU Ecodesign (LOT 20) proposal from July 2013.	EN13240	>70% (80%)****	<1500 mg/Nm^3	< 40 mg/Nm^3	< 80 mg/Nm^3	200 mg/MJ
P-mark	EN13240	70%	0.3% 3750 mg/m^3	100 mg/m^3	$200\ \mathrm{mg/m^3}$	-
Umweltzeichen 37 /Austrian	EN13240	80%	700 mg/MJ (1050 mg/Nm^3)	30 mg/MJ (45 mg/Nm^3)	50 mg/MJ (75 mg/Nm^3)	120 mg/MJ (180 mg/Nm^3)
15A Austrian (manually fed stove)	EN13240	> 78%	< 1100 mg/MJ (~ 1650 mg/Nm^3) (~ 0,13%)	< 60 mg/MJ (~90 mg/Nm^3)	< 80 mg/MJ (~120 mg/Nm^3)	< 150 mg/MJ (~225 mg/Nm^3)

BimSch. Stufe 1, valid until 31/12-2014	EN13240	>73%	<2000 mg/Nm^3	<100 mg/Nm^3	-	-
BimSch. Stufe 2, valid from 31/12-2014	EN13240	>73%	<1250 mg/Nm^3	<40 mg/Nm^3	-	-
DIN+, valid until 31/12-2014	DIN/EN 13240	> 75%	< 1500 mg/Nm^3 (~ 0.12%)	< 75 mg/Nm^3	< 120 mg/Nm^3	< 200 mg/Nm^3
DIN+, valid from 31/12-2014	DIN/EN 13240	> 78%	< 1500 mg/Nm^3 (~ 0.12%)	< 40 mg/Nm^3	< 120 mg/Nm^3	< 200 mg/Nm^3
Nordic Ecolabel (vers.3)	DS/EN13240 NS3058/3059 SP1695	> 75%	< 1700 mg/Nm^3 (~ 0.136%)	< 4 g/kg	< 120 mg/Nm^3	-
Nordic Ecolabel (vers.4)	DS/EN13240 NS3058/3059 SP1695	> 76%	< 1250 mg/Nm^3 (~ 0.1%)	Fra 1/7-2014 < 3g/kg Fra 1/7-2017 < 2g/kg	< 100 mg/Nm^3	-

**In the EN13240 standard, the number of particles is measured directly in the flue gas, in contrast to the Norwegian NS3058 standard, which is measures in the cooled flue gas. The threshold values for the two standards are therefore not directly comparable.*

*** The efficiency requirement is proposed to be defined as the stove's energy efficiency (70%) - converted to seasonal space heating energy efficiency this corresponds to energy efficiency of > 80%.*

Table 28. Official requirements and requirements in labelling schemes for pellet stoves

	Standard measurement method	**Efficiency**	**CO**	**Particles**	**OGC**	**NOx**
		nominal	**nominal**	**nominal low load**	**nominal**	**nominal**
Order No. 1432	NS3058 DIN/EN 14785	-	-	< 10 g/kg 75 mg/Nm^3	-	-
Rev.proposal Order No. 1432, valid from 1/7-2016	NS3058 DIN/EN 14785	-	-	< 4 g/kg 30 mg/ Nm^3	< 120 mg/ Nm^3 80 mg/Nm^3	-
EU Ecodesign (LOT20) proposal from July 2013	EN14785	>79% (89%)****	<250 mg/Nm^3	< 20 mg/Nm^3	< 40 mg/Nm^3	< 200 mg/MJ

15A Austrian (manually fed stove)	EN14785	>78 %	<500 mg/MJ (750 mg/Nm^3)	< 60 mg/MJ (~90 mg/Nm^3)	< 40 mg/MJ (~60 mg/Nm^3)	< 150 mg/MJ (~225 mg/Nm^3)
Umweltzeichen 37 /Austrian	EN14785	>90 %	120 mg/MJ (180 mg/Nm^3)	<20 mg/MJ (30 mg/Nm^3)	<6 mg/MJ (9 mg/Nm^3)	<100 mg/MJ (150 mg/Nm^3)
BimSch. Stufe 1, valid until 31/12-2014	EN14785	>85 %	<400 mg/Nm^3	<50 mg/Nm^3	-	-
BimSch. Stufe 2, valid from 31/12-2014	EN14785	>85%	<250 mg/Nm^3	<30 mg/Nm^3	-	-
DIN+	DIN/EN 14785	> 90%	< 200 mg/Nm^3	< 25 mg/Nm^3	< 10* mg/Nm^3	-
Der Blau Engel	EN14785	> 90%	< 180 mg/Nm^3	< 25 mg/Nm^3	< 10 mg/Nm^3	< 150 mg/Nm^3
P-mark	EN14785	>75%	1455 mg/m^3	<100** mg/m^3	55*** mg/m^3	-
Nordic Ecolabel (vers.3)	EN14785 NS3058/3059 CEN/TS15883	> 85%	< 800 mg/Nm^3	< 3.5 g/kg	< 60 mg/Nm^3	-
Nordic Ecolabel (vers.4)	EN14785 NS3058/3059 CEN/TS15883	> 87%	< 200 mg/m^3	<15 mg/m^3	< 10 mg/Nm^3	-

** Here, OGC is measured as CnHm and is thus not converted to OGC.*

*** Particles are measured according to NS3058,NS3059 and each individual sub-load < 100 mg/m3*

**** OGC is converted according to CEN/TS15883, SP1695.*

*** The efficiency requirement is proposed to be defined as the stove's energy efficiency (79%) - converted to seasonal space heating energy efficiency this corresponds to energy efficiency of > 89%.*

Table 29. Official requirements and requirements in other labelling schemes for heat-accumulating stoves

	Standard measurement method	**Efficiency**	**CO**	**Particles***	**OGC**	**NOx**
		nominal	**nominal**	**nominal low load**	**nominal**	**nominal**
EU Ecodesign (LOT 20) proposal from July 2013	EN13240	>70%*** (80%)	<1500 mg/Nm^3	< 40 mg/Nm^3	< 80 mg/Nm^3	200 mg/MJ

BimSch. Stufe 1, valid until 31/12-2014	EN15250	>75%	<2000 mg/Nm^3	<100 mg/Nm^3	-	-
BimSch. Stufe 2, valid from 31/12-2014	EN15250	>75%	<1250 mg/Nm^3	<40 mg/Nm^3	-	-
DIN+	EN15250	> 75%	< 1500 mg/Nm^3	< 75 mg/Nm^3	< 120* mg/Nm^3	<200 mg/Nm^3
Nordic Ecolabel (vers.3)	EN15250 CEN/TS15883	> 83%	< 1200 mg/Nm^3	< 50 mg/Nm^3	< 120** mg/Nm^3	-
Nordic Ecolabel (vers. 4)	EN15250 CEN/TS15883	> 83%	< 1250 mg/Nm^3	< 50 mg/Nm^3	< 100** mg/Nm^3	-

** Here, OGC is measured as CnHm and is thus not converted to OGC.*

*** OGC and particles according to CEN/TS15883:2009.*

*** The efficiency requirement is proposed to be defined as the stove's energy efficiency (70%) - converted to seasonal space heating energy efficiency this corresponds to energy efficiency of > 80%.*

Appendix 3 Requirements that have been discussed, but not included in the criteria

Materials and production requirements

Metal

Cast iron and steel production

(Reference BAT report: http://eippcb.jrc.es/reference/i&s.html)

Metal production has high local environmental impacts in the form of emissions, as well as high energy consumption. Generally, the use of waste iron (scrap) reduces energy consumption and equivalent emissions in metal production. In principle, fireplace manufacturers themselves can choose where they source metal, but the industry has many subsuppliers, which makes it difficult for small manufacturers of fireplaces to obtain this information.

Iron and steel production, approximately 20% recirculated iron/steel in metal production (in large-scale production for ore-based production). The production processes and the access to recirculated iron/steel vary considerably, which affects the ratio of recirculated iron/steel that can be used in production. Metal and scrap metal are a valuable material that is already recycled in iron/steel production today. The licence holders have little opportunity to control the development, so that it is not necessary for Nordic Ecolabelling to set requirements of the ratio of recycled metal.

Manufacturers of cast iron fireplaces already use 100% recirculated iron in their cast iron production. It is not necessary to set requirements for the ratio of recirculated metal.

Conclusion: The Nordic Ecolabel does not have sufficient opportunity to influence the development (and relevance) of the use of recirculated metal, as this is already incorporated in the production of iron/steel ad cast iron.

Glass production

Glass production (BAT: http://eippcb.jrc.es/reference/gls.html)

Borosilicate glass is the material most often used in fireplaces' glass doors and sides. It contains 70-80% SiO_2, 7-15% B_2O_3, 4-8% Na_2O or K_2O and 2-7% Al_2O_3. NB: Boro has characteristics that are hazardous to health and the environment. Lead hydrogen arsenate and triethyl arsenate are also used in the glass, and this cannot currently be substituted. Globally, there are two manufacturers of heat resistant glass for fireplaces: Schott Glass (Germany) and Keraglas (France).

The production of certain special types of glass may involve lead, arsenic, fluoride and other substances that the Nordic Ecolabel should prohibit in future criteria.

Conclusion: The Nordic Ecolabel does not make requirements of glass and components in glass in this criteria version. The Nordic Ecolabel does not have sufficient opportunity to influence the production of heat-resistant glass for fireplaces (only two manufacturers). Function (heat resistance) is important. The use of glass in fireplaces also plays an important role in enabling the consumer to exercise visual control of consumption.

Requirements of energy consumption in production

The Nordic Ecolabel works with energy/energy consumption and equivalent environmental impacts such as global warming, acidification, over-fertilisation, etc. Based on life-cycle analyses, as previously stated (chapter 5) the greatest share of the environmental impact occurs during the use phase (> 50%). Energy production during the actual manufacture of closed fireplaces for solid biofuel thus accounts for a small share of the total environmental impact, although it does have some significance. A new requirement of energy consumption in the manufacture of stoves has been discussed. The requirement might, for example, comprise energy consumption per unit produced. As the manufacturers use many different subsuppliers, it is very difficult for the licence holders to gain energy data for the various materials and semi-manufactures. In such case, a specification of the elements of production included in the required would be needed. The Nordic Ecolabel's view is that it is not possible at the present time to set requirements to restrict energy consumption in production. This is especially due to the problem with many subsuppliers. A new requirement for energy consumption in the production of closed fireplaces should be investigated more closely in conjunction with the next revision of the criteria.